London South Bank
University

Division of Accounting and Finance
Centre for Research in Accounting, Finance and Governance
School of Business

Financial crisis containment:
An analysis and evaluation of relevant actions applying a complex system approach

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DANIEL COPPI

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Abstract

Financial crises can be devastating. They wreak economic havoc within the economies of the relevant countries. Despite being extremely unwelcome they continue to reoccur and, interestingly, their features and root causes seem to be very similar. While there are accepted frameworks that outline the sequential stages of financial crises, the range of potential actions to contain them appear to be rarely academically assessed, or even identified. Such containment actions are diverse and undertaken by a variety of institutions. Thus, the aim of the research presented in this thesis is to provide insights that emerge from an analysis and evaluation of relevant financial crisis containment actions.

The analysis is undertaken applying a complex system approach to appropriate financial crisis variables-data. Complex systems theory argues that the effectiveness of actions cannot be assessed by an isolated analysis. Side-effects and interferences from other actions may, in fact, neutralise an intended effect. However, the consequences of actions can be identified by a range of analytical techniques associated with complex systems. Against that background, using models developed from extant theories of financial crises, financial markets and financial containment, such actions are inductively analysed in terms of their sustainability, strength and impact on key indicators. Then, a "mix" of appropriate containment actions is identified with their relative effectiveness.

The results of this analysis suggest that there is not a single all-embracing action that alone can contain a financial crisis. However, with varying consequences and degrees of effectiveness, there appear to be several containment actions that can help. Countries facing an isolated domestic financial crisis may apply only few actions to reach three desired key goals (i.e. increased asset prices, reduced risk of bank runs and stable foreign exchange rates). An international financial crisis however, seems to call for attention on other fronts. In these cases, central banks should arrange a harmonisation of monetary policies causing no changes of the foreign exchange rate. More containment actions are also of merit and could be applied. An historical evaluation of the identified "mix" of appropriate containment actions conducted as part of the thesis, in part, supports and strengthens the results of the systemic analysis. Implications, derived from the research, point to a weighted combination of effective containment actions that can be taken by central banks, governments and regulators when attempting to contain financial crises.

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Glossary

Table 0-1: Glossary

Term	Description
Action / Identified action	In order to contain the spread of an active financial crisis, different institutions can intervene in financial markets. For their activities, the terms “action” or “identified action” are used. All of them can be linked to one of the 28 elements of the developed system. More details are provided in Chapters 2.3 and 4.5.
Active	Classification of actions: Active elements are characterised by a high influence on and a low influence of other elements of the system. Actions should be initiated through active elements. More details are provided in Chapter 3.3.3.
Buffering	Classification of actions: Buffering elements are characterised by a low influence on and a low influence of other elements of the system. Actions should not be initiated by buffering elements. More details are provided in Chapter 3.3.3.
Critical	Classification of actions: Critical elements are characterised by a high influence on and a high influence of other elements of the system. Actions should not be initiated by critical elements. More details are provided in Chapter 3.3.3.
Elements	Elements are a component of a system. They are interrelated. More details are provided in Chapter 2.1.2.
Interferences	Various independently applied actions might neutralise each other. This analysis strives to identify recommendable combinations of actions to reach an intended impact on key elements of the system. More details are provided in Chapter 3.3.5.
Interrelations	Interrelations are a component of a system. They interrelate elements. More details are provided in Chapter 2.1.3.
Key elements	Within the developed systemic financial crisis model, there are elements that are more important than other elements. During financial crises, the containment actions seek to prevent the

Term	Description
	outflow of money, bank runs and drops in asset prices. Therefore, the Elements “Assets price”, “Liquidity of banks” and “Foreign exchange rate” are seen as key elements, indicating the survival of the system.
Passive	Classification of actions: Passive elements are characterised by a low influence on and a high influence of other elements of the system. Actions should not be initiated by passive elements. More details are provided in Chapter 3.3.3.
Potential new action	Potential new actions can be seen as actions that have not been mentioned in literature so far. All actions already known could be linked to elements. All remaining elements not linked to identified actions, are also within the scope of the analysis. They are named potential new actions.
Slightly sustainable	Classification of actions: An action can be seen as slightly sustainable if an intended effect of an action is repeated without the initiation of new actions. However, they are not as strong as sustainable actions. More details are provided in Chapter 3.3.2.
Sustainable	This research specifies this term as a characteristic of actions. An action can be seen as sustainable if an intended effect of an action is repeated without the initiation of new actions. More details are provided in Chapter 3.3.2.
Systemic	Approach, which considers complexity, including the interrelations of elements.
Unsustainable	Classification of actions: An action can be seen as unsustainable if an intended effect of an action is not repeated without the initiation of new actions. More details are provided in Chapter 3.3.2.

1 Research background, questions and structure

In its most fundamental form this thesis is about combining existing knowledge in order to find the best solution to solve a problem. The complex system approach is a method to combine existing knowledge. The knowledge to be combined comes from financial crises, financial markets and financial crisis containment and the solution lies in finding actions that effectively contain financial crises.

The first chapter explains the research background, states the research questions and introduces the thesis structure.

1.1 Research background

This chapter unveils the significance of this research and it introduces the motivation for this kind of research.

The last global financial crisis began in 2008. Governments and central banks intervened significantly. This was the starting point of this research. A review seeking an answer to the question, “What actions should be taken to stop the financial crisis”, identified a gap in knowledge. A large number of publications have been produced, recommending ways to prevent future financial crises. In contrast, recommendations about actions to contain the spread of an active financial crisis are rarely mentioned (Gelpern, 2009). A few available publications describe the intended effects of actions and provide overviews when they were applied to historical financial crises. Therefore, a list of actions to contain financial crises is available. However, the publications do not focus on an assessment of their effectiveness. In addition, the review of literature identified available theories on financial crises, financial markets and financial crisis containment, but they are not consolidated and, therefore, not entirely incorporated in available publications about the effectiveness of actions.

According to the system theory, the effectiveness of actions cannot be assessed by an isolated analysis of actions, considering only a few indicators (Doerner, 1997). All actions have side-effects and, when independently applied, might cause interferences neutralising the intended effect. Therefore, a concept was needed for this research, allowing the

integration of separate theories on financial markets, financial crises and financial crisis containment and providing analysis tools to assess their effectiveness. The concepts of complex systems cover the two aspects of modelling and analysis. There are various concepts available to consider systemic aspects (see Chapter 2.1). Their application depends on the availability of data and theories. For financial markets, a large volume of data (e.g. prices, exchange rates, interest rates) are available and have already been used in many studies and research projects to develop new theories. However, there is another complex system concept, characterised by a smaller need for large data sets. This concept does not begin with the analysis of raw data but with the theories developed by other scientists, who analysed raw data. Brand (2013), Ulrich and Probst (1991) and Vester (2007) developed a concept to combine different theories into a complex system (see Chapter 4). This complex system forms the basis of an analysis of the effectiveness of actions with quantitative methods (see Chapter 3.3). It combines relevant theories about financial crises, financial markets and financial crisis containment. The developed complex system contains 28 elements and 61 interrelations representing an unspecified currency area.

This section introduced the significance of this research, the motivation for applying the complex system approach. The next section derives the research questions.

1.2 Research questions

The aim of this research is it to analyse financial crisis containment actions by the application of a complex system approach, which identifies direct and indirect effects of actions and allows an assessment of their effectiveness. In addition, those results are historically evaluated.

A systemic analysis requires a financial crisis model, taking into account existing theories about financial crises, financial markets and financial crisis containment actions (Research Objective 1).

The Research Objective 2 is the analysis of financial crisis containment actions by applying the tools of complex systems in order to assess their effectiveness. In this research, the effectiveness is measured by the four analysis methods including

sustainability of actions, their strength, their impact on key elements within the system and potential interferences of actions neutralising effects (see Chapter 3.3).

Actions are spread across different institutions. Five research questions can be linked to this second research objective:

Research Question 1:
How effective are the crisis containment actions of central banks?

The containment actions are listed in Chapters 2.3 and 4.5.1. The results of the analysis are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1. The results are discussed in Chapter 7.1.1.

Research Question 2:
How effective are the containment efforts of the lenders of last resort?

The containment actions are listed in Chapters 2.3 and 4.5.2. The results of the analysis are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1. The results are discussed in Chapter 7.1.2.

Research Question 3:
How effective are the crisis containment actions of governments and regulators?

The containment actions are listed in Chapters 2.3 and 4.5.3. The results of the analysis are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1. The results are discussed in Chapter 7.1.3.

Research Question 4:
Which potential new containment actions might be effective?

The results of the analysis of potential new containment actions are documented in Chapters 5.1.2, 5.2.2 and 5.3.2 and summarised in Chapter 5.4.2. The results are discussed in Chapter 7.1.4.

Research Question 5:

Which combination of financial crisis actions causes interferences? Interferences can occur if various independently applied actions are applied and their effects neutralise each other. This analysis strives to identify recommendable combinations of actions to reach an intended impact on key elements of the system.

The results of the analysis are documented in Chapter 5.5. The results are discussed in Chapter 7.1.5.

Financial crises have occurred continuously. A lot of information and experience pertaining to market interventions are available. Research Objective 3 is to strengthen the results of the complex system analysis of developed recommendations drawn from the use of the complex system approach. These results are compared with the success of historical financial market interventions. A high degree of conformity would indicate plausibility of the systemic results. The linked sixth research question is the following:

Research Question 6:

To what extent do the results of a complex system analysis of financial crisis actions conform to successful historical market interventions?

The outcome of the historical evaluation is documented in Chapters 6.1.2 to 6.1.7 and summarised in Chapter 6.2. The results are part of the discussion of Chapters 7.1.1, 7.1.2 and 7.1.3.

This section revealed the derived six research questions. The next section explains the chosen research approach to answer the questions.

1.3 Research structure

Having introduced the background and research questions in the previous section, this part unfolds the research structure. In the beginning, four research steps are described, summarising all research activities. More details can be seen in Chapter 3.1. At the end of this section all chapters of this thesis are outlined.

This research follows a complex system approach in having four steps.

First, existing theories about complex systems, financial crises and financial crisis containment actions are examined. Second, a systemic financial crisis model is developed. Existing theories about financial crises and financial markets are synthesised into a big picture. Identified causalities of these theories are transferred to elements and interrelations of complex systems. This developed model forms the basis to analysing identified financial crisis containment actions from the perspective of a complex system approach. Third, the results of the analysis are matched with actual interventions applied during historical financial crises in order to evaluate their effectiveness. Fourth, the conclusions of the systemic analysis and the historical evaluation are compared with other studies. A simplified visual representation of the research approach of this thesis is shown in Figure 1-1.

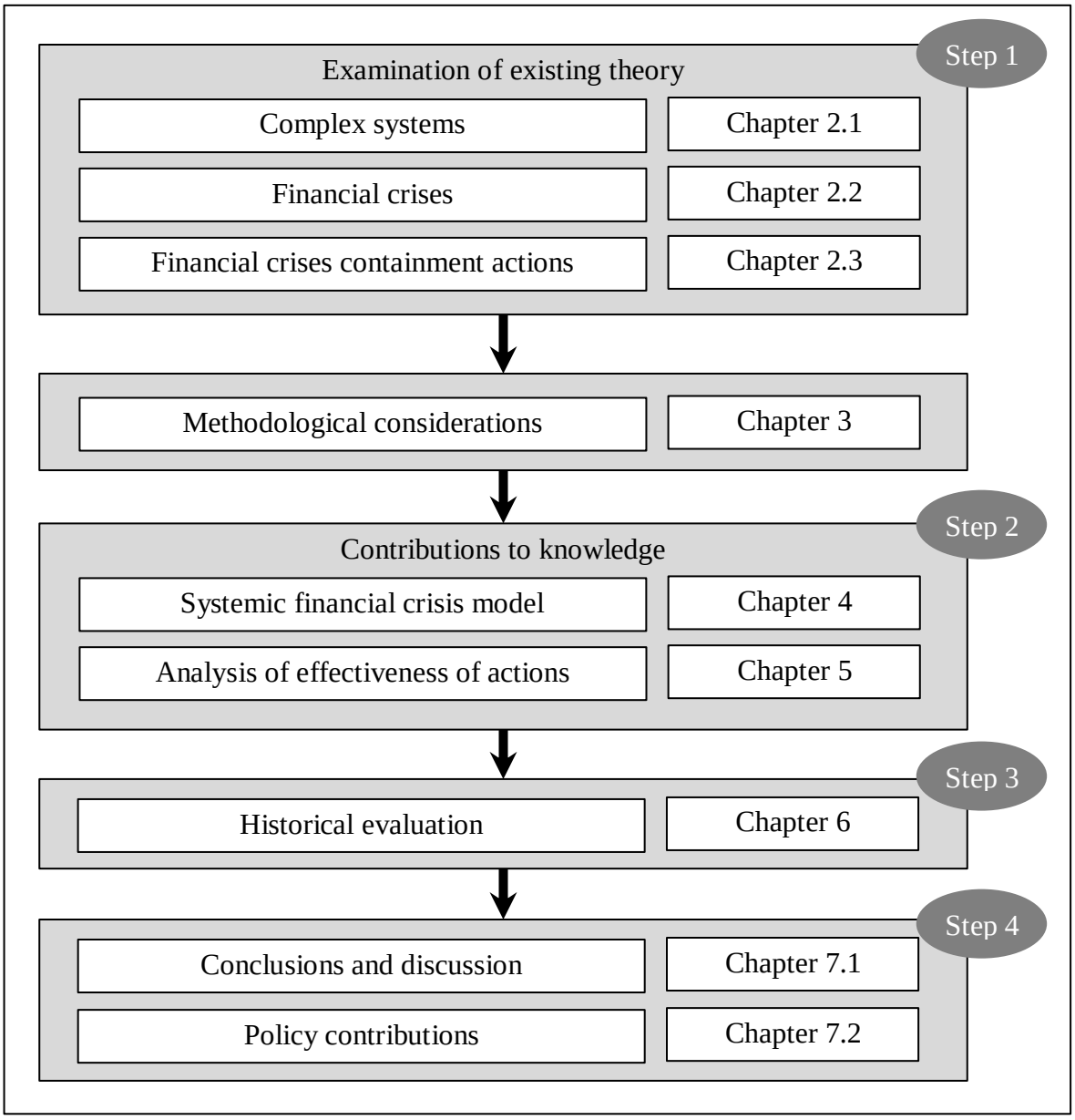


Figure 1-1: Research approach of this research

This thesis contains the following chapters:

Chapter One describes briefly the research background, the research problem and the research structure.

Chapter Two introduces the research concept. It deals with the basic literature and theories of a complex system approach, financial crises and financial crisis containment actions. This chapter defines the basic terms and introduces existing concepts that serve as the basis for the steps of developing a financial crisis model, identifying financial crisis containment actions and their analysis.

The concepts of systems and their complexity are developed in different scientific fields. This chapter shows that systems comprise elements and interrelations and explains existing tools to analyse the impact of adjustments on systems.

In addition, this chapter provides a definition of financial crises and describes their typical stages that form the basis of the systemic financial crisis model.

Financial crisis measures are categorised according to their aims and occurrence in this chapter. Actions of financial crisis containment are delinked from financial crisis prevention and financial crisis resolution.

Chapter Three outlines the research methodology. This section summarises the originality of this research, lists all research activities and indicates general philosophical specifics of this research and, in particular, philosophical specifics of a complex system approach. In addition, this chapter discusses the research design, the relevant theoretical methods of the applied complex system approach and the historical evaluation as well as the limitations of this research.

The first section summarises the originality of this research and lists the research objectives, the research questions and the accomplished research activities in detail.

The philosophical section focuses on the nature of knowledge and shows details to the questions "What is knowledge?" and "What can we know?". The complex system philosophy is characterised by the missing link to the experienced world. Instead of theorising the real world, different theories about the experienced world are combined and integrated. Important views on this aspect are described.

The different phases of this research are described and categorised according to views on various research dimensions.

While Chapter Two introduces the complex system approach, this chapter shows the details of the analysis. It explains how sustainability, strength, impact and interferences of actions are measured.

This research concentrates on the complex system approach. In addition, the results are historically evaluated. The advantages, difficulties and the rationale for choosing the approach are described and justified.

The last section shows the limitation of this research. They are related to the research approach, the developed model and the historical evaluation.

Chapter Four describes the existing theories of financial crisis, financial markets and financial crisis containment and, on this basis, a complex system model is constructed.

The majority of the systemic model is based on the behaviour during the different stages of financial crises (i.e. displacement, expansion of credit, euphoria and critical stage and revulsion). The first stage, displacement, is detailed by the theories of basic price relations and asset prices. The second stage, expansion of credit, is characterised by higher return rates of assets compared to the costs of debts. Theories about credit leverage, creditworthiness, credit cash flow and principal payments are integrated. Later, the third stage, euphoria, starts. The rush of prices leads to expectations of higher prices. Theories about non-rational markets, speculation, price correction mechanisms, herd behaviour, moral hazard and fraud are considered. Significant price drops cause liquidity problems for

financed investors and the entire financial environment. The modelling includes the topics exuberant prices, over-indebtedness, contagion and bank runs.

The catalogue of actions is highly diverse and distributed over a range of institutions. This research differentiates between central banks, lenders of last resort and governments and regulators.

In addition, all relevant causalities are summarised. The incoming and outgoing interrelations for each element are shown. The entire model is visualised, mathematically described and the content-related assumptions are defined.

Chapter Five contains the results of the systemic analysis and interpretations. Actions are analysed with regard to sustainability, strength, impact and interferences.

Sustainable effects in systems are generated by feedback caused by cycles showing the interrelation or chain of interrelations of one element to itself. An sustainable impulse to the system can cause positive effects without additional efforts.

Some elements cause a higher impact on the system. They are more suitable for actions.

Even sustainable and powerful actions do not necessarily have positive effects on key elements of the system. The impact analysis identifies the paths of the actions to those key elements.

Sustainable and powerful actions with a positive impact might be ineffective due to the application of other actions. Their interferences are analysed.

Chapter Six seeks to strengthen the results of chapter five by a historical evaluation. Historically applied containment actions are compared to general criteria of successful crises-handling. For a few financial crises, data could be collected and analysed.

Chapter Seven is the final and concluding chapter of this thesis. It offers a discussion on the outcome and the policy contributions, besides also suggesting further research.

The **Appendices** show the detailed tables of the analyses. Owing to the enormous lengths of the tables, the data are separately printed in the second volume of this thesis. In addition, an overview shows the links of relevant literature to the research objectives and the research activities

This chapter illustrated the basic research activities and unfolded the chapter structure of this thesis. The next chapter introduces three different very basic concepts fundamental to the research approach.

2 Conceptual considerations for the research approach

This research analyses the actions of financial crisis containment by applying a complex system approach. This chapter introduces the necessary concepts.

The first section “The complex system approach“ places the basic idea of complex systems, delimitates different concepts of complexity and describes their components and analytical methods. This concept serves as the basis for explaining the systemic modelling of Chapter 4 and the systemic analyses of Chapter 5.

There are different views on financial crises. Chapter 2.2 defines them and describes their characteristics and root causes. Different stages of financial crises are specified. They are the framework for the modelling of the financial crisis system of Chapter 4.

Potential actions to curb the spread of an active financial crisis are highly diverse. Section 2.3 differentiates groups of actions and links them to relevant institutions. The description of actions and their impact on the developed system are described in Chapter 4.5.

2.1 The complex system approach

This chapter introduces the idea of a complex system approach. It is the basis for the modelling of financial crises (Chapter 4). The philosophical view of the chosen complex system approach is described in Chapter 3.2.

This section begins with the section “Complex systems” introducing different concepts and providing a definition. The subsequent sections “Elements” and “Interrelations” describe the basic components of a complex system and their potential features. The last section briefly introduces the analytical methods. More details are provided in Chapter 3.3.

2.1.1 Complex systems

This section starts with an overview of complex system concepts and defines the complex system approach for this research.

The concepts of systems and complexity are developed by several scientists from different scientific fields. Some overviews of the different concepts have been developed (Brand, 2013; Castellani, 2013; Ropohl, 2012; Umpleby, 2005). Figure 2-1 shows summarises them. The initial contributors are described in Table 2-1.

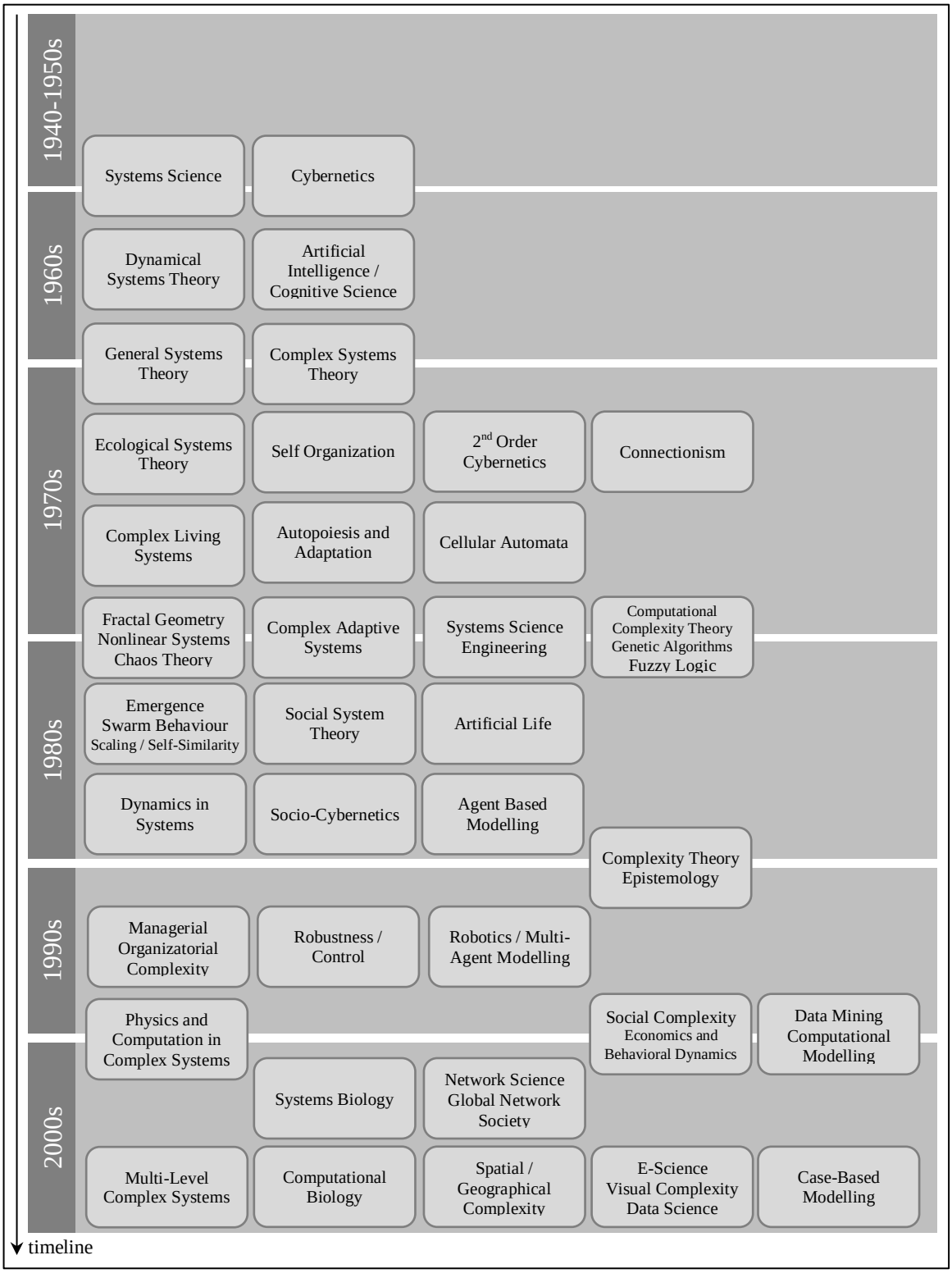


Figure 2-1: Overview of concepts in the complex environment
Source: Adaptation from Castellani (2013)

Table 2-1: Overview complexity concepts and important initial contributors
Source: Adaptation from Castellani (2013)

Concept	Initial contributors
Dynamical Systems Theory	Donella Meadows
Fractal Geometry Nonlinear Systems Chaos Theory	Yaneer Bar-Yam, James Crutchfield, Doyne Farmer, Mitchell Feigenbaum, Alfred Hubler, Edward Lorenz, Benoit Mandelbrot, Tien Yen Li, James Yorke
Physics and Computation in Complex Systems	James Crutchfield, Doyne Farmer, Stephanie Forrest, Yamir Moreno
Multi-Level Complex Systems	Carlos Castillo-Chavez, Per Lötstedt, Yamir Moreno
Systems Science	Gregory Bateson, Ludwig van Bertalanffy, Kenneth Boulding, Margret Mead, Anatol Rapoport
General Systems Theory	Ludwig van Bertalanffy, James Grier Miller, Donella Meadows
Ecological Systems Theory	Howard Thomas Odum
Complex Living Systems	Per Bak, Eshel Ben-Jacob, Fritjof Capra, James Lovelock, Lynn Margulis
Managerial Organizatorial Complexity	Russell Ackoff, Yaneer Bar-Yam, Stafford Beer, Eric Bonabeau, Peter Checkland, Doyne Farmer, Gilbert Probst, Kurt Richardson, Hans Ulrich, Frederic Vester
Systems Biology	Carlos Castillo-Chavez, Jean-Louise Deneubourg, Stephanie Forrest, Robert May
Computational Biology	Carlos Castillo-Chavez, Jean-Louise Deneubourg, Stephanie Forrest, Robert May, Yamir Moreno
Complex Systems Theory	Warren Weaver
Self Organization	Per Bak, Herman Haken, Erich Jantsch, Humberto Maturana, Ilya Prigogine, Francisco Varela
Autopoiesis and Adaptation	Stuart Kauffmann, Humberto Maturana, Francisco Varela
Complex Adaptive Systems	Herman Haken, Stuart Kauffmann, Ilya Prigogine
Emergence Swarm Behaviour Scaling / Self-Similarity	Eshel Ben-Jacob, Eric Bonabeau, Jean Carlson, Jean-Louise Deneubourg, John Doyle, Herman Haken, Stuart Kauffmann, Geoffrey West
Dynamics in Systems	Yaneer Bar-Yam, Samuel Bowles, Jean Carlson, Jean-Louise Deneubourg, John Doyle, Steve Strogatz, Geoffrey West
Robustness / Control	Yaneer Bar-Yam, Jean Carlson, John Doyle, Geoffrey West
Network Science Global Network Society	Albert-Lazlo Barabasi, Manuell Castells, Nicholas Christakis, Mark Granovetter, Bruno Latour, Steve Strogatz, John Urry, Immanuel Wallerstein, Duncan Watts, Barry Wellman
Spatial / Geographical Complexity	Albert-Lazlo Barabasi, Michael Batty, Manuell Castells, David O`Sullivan, Nigel Thrift, John Urry, Immanuel Wallerstein
Cybernetics	W. Ross Ashby, John von Neumann, Arturo Rosenblueth, Claude Shannon, Nobert Wiener
2nd Order Cybernetics	Heinz von Foerster, Jay Forrester
Systems Science Engineering	Jay Forrester, Deborah Hammond, George Klir

Concept	Initial contributors
Social System Theory	Niklas Luhmann, Talcott Parsons
Socio-Cybernetics	Niklas Luhmann, Francisco Parra-Luna, Talcott Parsons
Complexity Theory Epistemology	David Byrne, Paul Cilliers, Chris Jenks, Bruno Latour, Ervin Laszlo, Edgar Morin, John Smith
Social Complexity Economics and Behavioral Dynamics	Samuel Bowles, David Byrne, Brian Castellani, Lasse Gerrits, Nigel Gilbert, Friedrich Hayek, John Miller, Scott Page, Jajeev Rajaram
E-Science Visual Complexity Data Science	Katy Börner, Brian Castellani, Manuel Lima, MIT Media Lab, John Taylor, Fernanda Viegas, Martin Mattenbergas, Jajeev Rajaram, Duncan Watts
Artificial Intelligence / Cognitive Science	Warren McCulloch, John von Neumann, Frank Rosenblatt, Walter Pitts
Connectionism	Teuvo Kohnen, John von Neumann
Cellular Automata	John Conway, John Holland, John von Neumann, Stephen Wolfram
Computational Complexity Theory Genetic Algorithms Fuzzy Logic	Murray Gell-Mann, John Holland, Andrei Kolmogorov, Bart Kosko, Seth Lloyd, Heinz Pagels, Stephen Wolfram, Lotfi Zadeh
Artificial Life	Christopher Langton
Agent Based Modelling	Robert Axelrod, Robert Axtell, Joshua Epstein, Nigel Gilbert, Thomas Schelling
Robotics / Multi-Agent Modelling	Katia Sycara, Michael Wooldridge
Data Mining Computational Modelling	Robert Axtell, Joshua Epstein, Douglas Hofstadter, Melanie Mitchell, Gregory Piatetsky-Shapiro, Jeanette Wing
Case-Based Modelling	David Byrne, Brian Castellani, Lasse Gerrits, Charles Ragin, Jajeev Rajaram, Emma Uprichard

Holland (2014) suggests the differentiation of two basic concepts of complexity. The elements of “complex physical systems” depend typically on the effects of the nearest neighbours. The elements of “complex adaptive systems”, called agents, in contrast, depend on an interaction with other agents, considering their learning process. Hard and soft modelling can be another classification. If the degree of quantification is high, the concept is called hard modelling. The modelling with a lesser degree of quantification is called soft modelling. Soft modelling tools, applied in this research, provide solutions to specific social and business problems. Concepts for the solution of social and business problems are characterised by leaving out details in order to take a broad range of interrelations to other scientific aspects into account. The goal is to get deeper insights into

real-world problems that cannot be analysed in laboratories. (Checkland, 1981; Maani and Cavana, 2000). Important representatives of the soft modelling approach with modelling aspects and analytical techniques are Brand (2013), Checkland (1981), Doerner (1997), Herder-Dornreich (1993), Hub (2002), Maani and Cavana (2000), Ulrich and Probst (1991) and Vester (2007). However, these tools are rarely applied to financial science. Foster (2004) suggests that this can be explained by the knowledge structure of economists who are specialised experts, focussing on details like optimisation in the allocation of resources, production and products rather than analysing interrelations to other aspects. The necessity of a complex system approach is discussed in many publications and Bertalanffy (1969), Blauberg et al. (1977), Checkland (1981), Hayek (1967), Hooker (2011), Laszlo (1984) and Luhmann (1995) provided also philosophical contributions. Chapter 3.2 summarises the core aspects.

A large variety of scientific streams on complex systems have resulted in a broad range of definitions of complex systems. Blauberg et al. (1977) present a short list. However, Mueller (2011) collected more than 200 different definitions. The most common definition is that it is "a set of elements standing in interrelations" (Bertalanffy, 1969, p. 55; Luhmann, 1995, p. 44). Figure 2-2 depicts the concept of elements and interrelations. Various scientists (e.g. Brand (2013), Ulrich and Probst (1991) and Vester (2007)) applies this kind of visualisation to show the effects within the system (i.e. the impact of elements to other elements) and, therefore, is named impact graph. Details are described on the next pages.

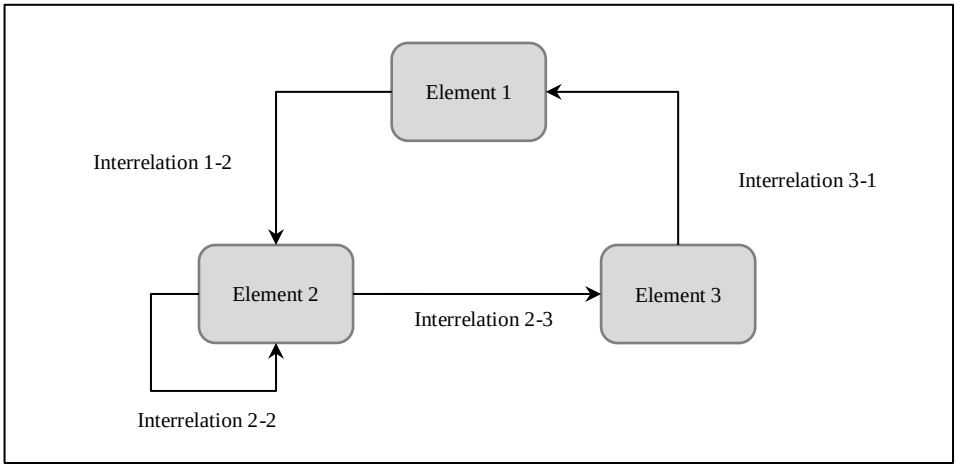


Figure 2-2: Set of elements standing in regulated interrelations

The function of systems is defined by their borders to the environment. In a system without any relation to the environment (a closed system), the final state of the system is determined by the initial conditions and is only influenced by its own past behaviour (Bertalanffy, 1969). An open system is linked to the environment. Figure 2-3 shows this aspect of systems.

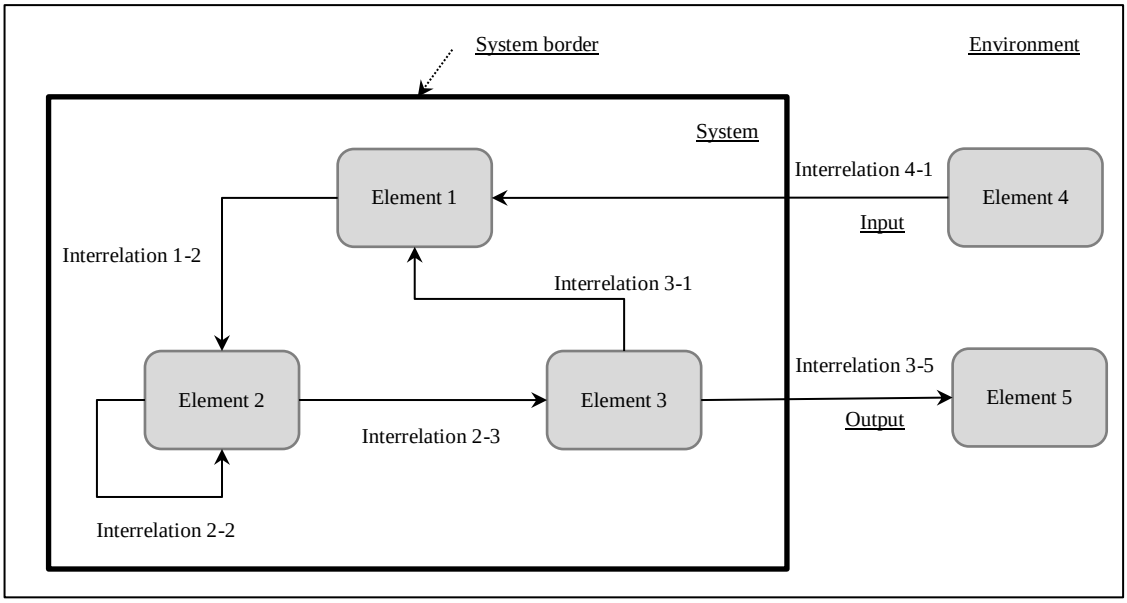


Figure 2-3: System and its environment

This section described different concepts of complex systems and defined a complex system approach in terms of elements and interrelations. Both are dealt with in the next two sections.

2.1.2 Elements

The preceding section defines a complex system approach by elements and interrelations. This section describes the role of elements for system borders and sub-systems. It ends with a technical view on the measurement of the behaviour of elements.

The role of an element within a system is precisely defined.[1] Elements can be both a part of the system or of its environment (Luhmann, 1995).

[1] The terms "variable" and "vertex" can be used as synonyms for the term "element" in this research.

An element may be described by sub-systems and the entire system might be an element of a higher system (Bertalanffy, 1969; Checkland, 1981). Greater knowledge of sub-systems improves the understanding of the entire system (Maani and Cavana, 2000). Figure 2-4 visualises this idea.

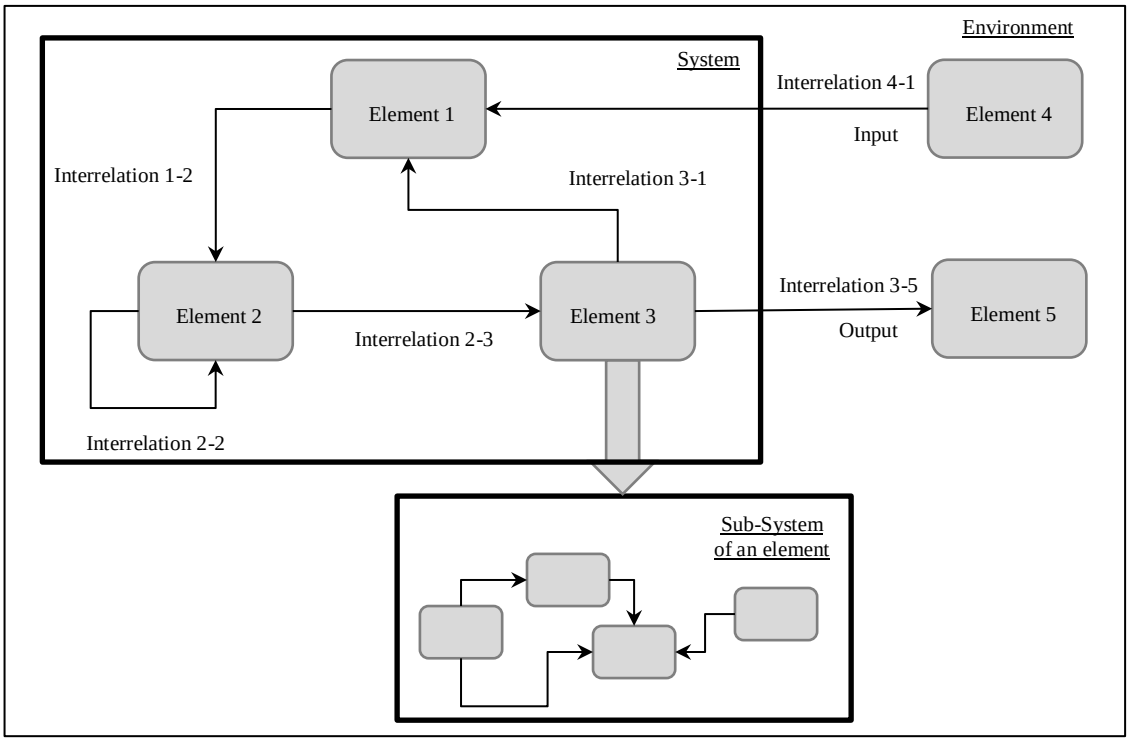


Figure 2-4: Sub-systems

The different complex system concepts provide various modelling approaches to analyse the behaviour of elements. The value at each point in time can either be defined by the net difference between inflow and outflow without considering the previous value of the element itself.[2] The concept of Forrester (1968) is an example of this approach. In other concepts, the values of elements depend on their past values (Brand, 2013; Hub, 2002; Ulrich and Probst, 1991; Vester, 2007).

This section outlined the role of elements inside and outside of systems and explained modelling aspects. The next part introduces greater details of interrelations, the second component of complex systems.

[2] There is one exception. It depends on the initial value.

2.1.3 Interrelations

After giving additional details about elements in the previous pages, the following section presents the background of the second part of the definition of complex systems. It introduces the interrelations. First, their effects and differences between positive and negative interrelations are outlined, including ways to prevent pitfalls in the interpretation. The modelling aspects of interrelations are summarised in the end.

Aristotle's expression "the whole is greater than the sum of its parts" is based on interrelations between elements within a system (Bertalanffy, 1969).[3] Changes in one element influence its interrelated elements. A large number of interrelations between elements are described by the term "complexity" (Doerner, 1997). Foster (2004) emphasises that elements in complex systems are never fully connected. They are partly interrelated.

The soft-modelling approaches of Ulrich and Probst (1991) and Vester (2007) specify an interrelation by its direction and intensity. The direction of an interrelation between two elements can either be positive or negative. A positive effect represents a change in a source element that causes a change in the receiving element in the same direction. A negative effect means that a change in a source element causes a change in the receiving element in the opposite direction. Figure 2-5 shows Elements 1, 2 and 3. An increase of Element 1 increases Element 2 (positive interrelation). An increased Element 2 decreases Element 3 (negative interrelation). There are different options to visually depict the interrelations. This research applies the approach of Vester (2007) who used dotted lines to represent negative interrelations and plain lines to show positive ones.

[3] The terms "edge" and "connection" can be used as synonym for the term "interrelation" in this research.

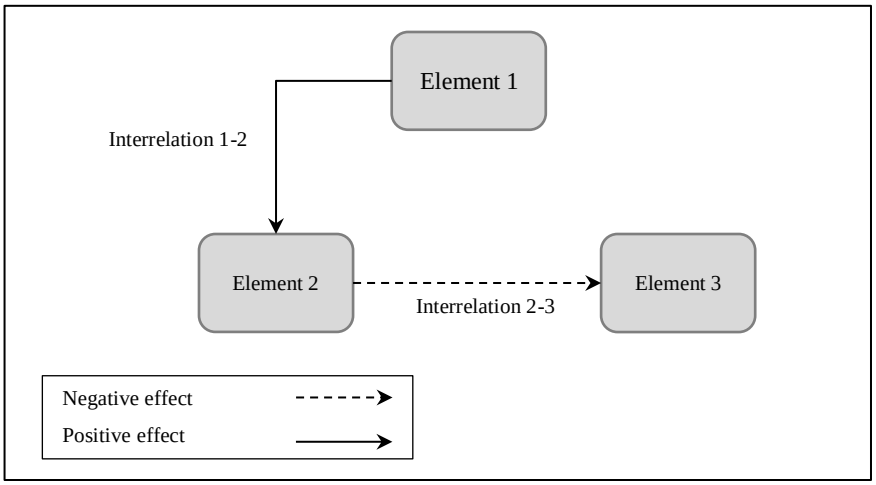


Figure 2-5: Types of interrelations in qualitative models

There are specifics to be considered in the interpretation of interrelations. The following example illustrates the pitfalls. There are partly interrelated elements "population", "births" and "deaths". More births increase the population. This is a positive interrelation. However, fewer births do not reduce the population. It still increases the population. Nevertheless, a decrease in the birth rate changes the value of the population, which would have been greater without a change in the birth rate. Relatively, a decrease in the birth rate reduces the population. The same situation arises in the opposite case of deaths and population. A higher number of deaths reduce the population. Fewer deaths reduce the population as well. However, a decrease in the death rate changes the value of the population, which would be smaller without a change in the death rate. Relatively, a decrease in the death rate increases the population (Maani and Cavana, 2000; Meadows et al., 1972; Richardson, 1986). The effects of the interrelations are exactly defined in Chapter 4 in order to prevent misinterpretations.

Existing interrelations are shown in an adjacency matrix. The adjacency matrix is a mathematical representation of a graph visualising complex systems. The matrix's rows and columns are labelled according to the system's elements. The interrelations of the system are shown by the matrix cells. If there is an interrelation, the cell contains the value 1; otherwise, the value is 0. The direction of an available interrelation is defined by its position within the matrix. The rows of the matrix show the starting point of the interrelations and the columns their destinations (Brand, 2013). The interrelation's level of intensity to the receiving element might be modelled in different ways. The concepts of Hub (2002), Ulrich and Probst (1991) and Vester (2007) allow three different values (weak

interrelation, standard interrelation, strong interrelation), which can be seen as discrete form of correlation between elements. All concepts assume that there is no loss of intensity during transfer. Time delay effects of interrelations are partly considered in the complex system concepts. Brand (2013), Hub (2002) and Ulrich and Probst (1991) integrate time delays. In contrast, Vester (2007) analyses systems without the time factor.

After the introduction of elements in the previous part of the thesis, this section completed the view on complex systems by providing greater details about interrelations. In particular, their effects and modelling aspects were outlined. The next section shows how complex systems can be analysed from a quantitative perspective.

2.1.4 Types of analyses

The last pages illustrated the concept of complex systems. The upcoming portion delineates two basic techniques to analyse systems quantitatively and summarise the applied quantitative tools of this research.

Bertalanffy (1969) observed that minor adjustments in systems can have considerable impact. Sullivan (2012) summarises that people tend to have difficulties in understanding complex systems. In fact, he claimed that there was no real difference between activities of animals and men beyond a rising scale of complexity. Therefore, Ashby (1956) emphasises that the question “what does it do?” needs to be answered instead of “what is this thing?”.

A range of tools have been developed to analyse systems. In general, the analysis of complex systems differentiates between the analysis of the system structure and the simulation of the system’s behaviour. Simulation runs quantify the system behaviour and allow a subsequent interpretation. In addition, the simulated behaviour can be compared with the actual behaviour of the reality. However, simulations require comprehensive and accurate data. Structural analyses can be applied without large data sets. An initial value is not required and interrelations between elements can be modelled by simple linear functions.

The following quantitative tools are applied in this research (details are described in Chapter 3.3).

Sustainability of actions

Sustainable effects in systems are generated by feedback. Elements are interrelated and cycles show the interrelation of one element to itself. Feedback loops are closed cycles of interrelations. Without a corrective element, the value of elements can move away from the initial value (Forrester, 1968). This happens in case of positive cycles, where an initial positive impulse repeats itself. Wiener (2013) emphasises that negative cycles stabilise systems. An initial positive impulse is transformed into a negative effect after the first iteration. After the second iteration, the negative effect is transformed into a positive effect followed by a negative effect. Therefore, positive cycles amplify the initial impulse and a negative cycle neutralises an initial impulse. Elements may be classified according to their involvement in cycles. Financial crisis containment actions initiate a specific impulse in the system. The sustainability analysis counts the cycles and shows if the impulse is repeated or neutralised.

Systemic roles of elements

Elements may be classified according their ingoing and outgoing interrelations in order to assess their roles within the system. Ulrich and Probst (1991) and Vester (2007) developed an advanced method. Elements with a high number of outgoing interrelations have a greater impact on the system. Elements with a large number of ingoing interrelations indicate changes in the system.

Impact of actions

Elements may be classified according their impact on specific key elements of the system. Paths show the interrelation of the chain of interrelations of one element with one of those key elements. Elements with a higher number of positive paths to a specific element indicate that the initial impulse is directly transferred. Elements with a higher number of negative paths to other elements indicate that the initial impulse is reversely transferred. Brand (2013) describes the methods and mathematical tools comprehensively.

Interferences of actions

Identified sustainable and effective actions might be ineffective due to the application of other actions. This analysis cumulates the results of the analysis “Impact of actions” and shows their combined effects.

This section summarised the applied quantitative tools of this research and completed the introduction of a complex system approach. The next parts focus on the fundaments of the systemic financial crisis model and the containment actions.

2.2 Definitions and characteristics of financial crises

Chapter two introduces the three most basic aspects of this research. The previous section described the idea of complex systems whose methods are applied to the subject of financial crises. This section introduces financial crises and describes their characteristics.

A definition of a crisis is always linked to the questions of "What is a normal situation?". There are different views on financial crises. The first part of this section provides an overview and defines the term for this research.

It is followed by a short description of different stages of financial crises. Galbraith (1993) suggests that financial crises are similar because every new generation of market players makes the same mistakes as the generation before. The new generation believes in its own innovative genius. Minsky (2008) as well as Kindleberger and Aliber (2005) identified the typical stages of financial crises that provide the basis for the systemic modelling. They are briefly described in the second part of this section. They are dealt with greater details in Chapter 4.

2.2.1 Definition of financial crises

This research approaches the term "financial crisis" from various angles, such as financial markets, assets and economic definitions and finds a clear definition from a financial perspective.

Financial markets channels funds from parties that have saved funds to those that have a shortage of funds (Mishkin, 2010). In other words, the product in financial markets is liquidity for assets (Minsky, 2008). Financial markets are differentiated into primary markets, where a party with money provides directly to the receiving party by issuing of a security, and secondary markets, where parties can sell already issued securities to receive

liquidity (Mishkin, 2010). In addition, the market's function is to determine the price of that liquidity (Vogl, 2011).

There are different types of assets and the use of money determines the classification. Basically, the "active" side of the balance sheet differentiates between equipment, real estate, intangible assets and financial assets. Financial assets might be stocks, funds, derivatives or loans. Galbraith (1993) does not limit the types of assets. He maintains that all types of assets may be priced, including art and banknotes.

Reinhart and Rogoff (2009) differentiate between inflation crises, currency crashes and currency debasement. In their concept, an inflation crisis is defined if the annual inflation rate is higher than 20% and a currency crash occurs when the currency depreciates more than 15% compared to a reference currency within 12 months. A currency debasement includes two types. Type I is the reduction of the metallic content of coins by 5%. Type II is a currency reform with an already depreciated currency. In addition, they mention banking crisis, external default and domestic default. A banking crisis can be defined as bank runs or as a support to important financial institutions in order to maintain the viability of the banking sector. An external or domestic debt crisis is evident from the failure to meet principal or interest payments on a loan.

From a financial perspective, a financial crisis can be seen as a dramatic decrease in asset prices within an extremely short period. Vines (2003) contends that a volatility larger than 5% in a day can be seen as an unusual price movement. Baro and Ursúa (2009) use the same concept but different numbers for their definition. They define a financial crisis as a price drop of more than 25% per year. According to the theories of rational financial markets the likelihood of large price drops is quite low and should seldom happen (Jackwerth and Rubinstein, 1996). However, financial crises have occurred continuously. Within the time span 1975 to 2006 alone, more than 70 crises have occurred globally, including defaulting by banks and governments (Reinhart and Rogoff, 2008). In fact, Baro and Ursúa (2009) counted more than 200 crashes in the last few decades giving rise to the question posed by Schulze (2013): What is a normal situation if crises, that are intrinsically defined as a deviation from a normal situation, happen normally?

This section defined financial crises. In the next part of the thesis, the typical stages of financial crises are outlined.

2.2.2 Characteristics of financial crises

Minsky (2008) as well as Kindleberger and Aliber (2005) have identified the typical stages of financial crises and developed a financial crisis framework.[4]

Financial crises start with the displacement to attractive assets, followed by the extension of financed investments and euphoria before the critical stage and revulsion begins.

Figure 2-6 shows those interrelations in a simple model. Displacement, leading to higher asset prices, expanses credit to invest in those assets. Higher prices lead to euphoria that further increases prices and attracts more credit. Those cycles might be initiated by macroeconomic elements. However, greater credit simultaneously leads to a critical stage and, finally, to a revulsion triggering negative effects on credit availability, asset prices and macroeconomic elements. The whole system bursts. More details are described in Chapter 4.

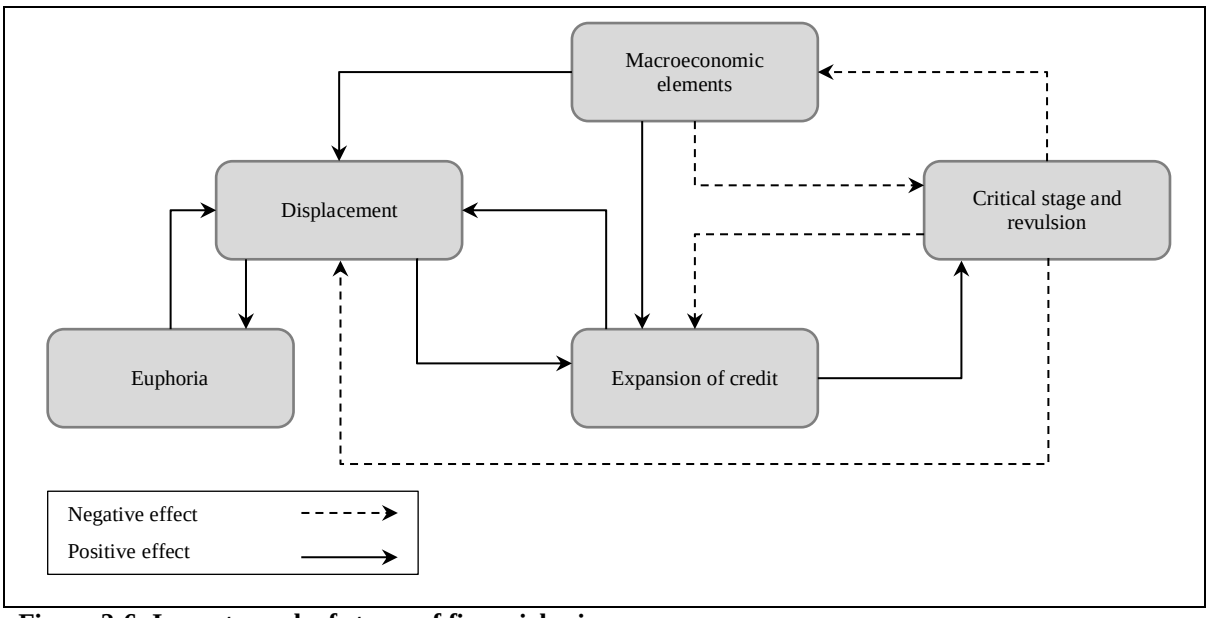


Figure 2-6: Impact graph of stages of financial crises

[4] In literature, the number of stages and their names differ.

This section illustrated the characteristics of financial crises. They are the basis for the systemic modelling of financial crisis. The next pages show actions that can be applied with the intention of stopping financial crises.

2.3 Containment of financial crises

The aim of this research is the analysis of financial crisis containment actions by applying a complex system approach. The previous sections of this second chapter introduced complex systems and financial crises. This section is about containment actions. It unfolds a definition and a delimitation of other actions that can be applied before and after a financial crisis occurs. In addition, moral hazard aspects are outlined. At the end, institutions involved in financial crises are summarised. A description of the tool-sets can be found in Chapter 4.5.

Financial crisis containment strives to avoid the spread and the consequent impact of an active financial crisis (Gelpern, 2009; Singh and LaBrosse, 2011). Roubini and Mihm (2011) compared crisis containment with the activities of a fire department. A fire department tries to avoid the spread of the fire to other places in order to save lives even if the blaze is caused by negligent behaviour.

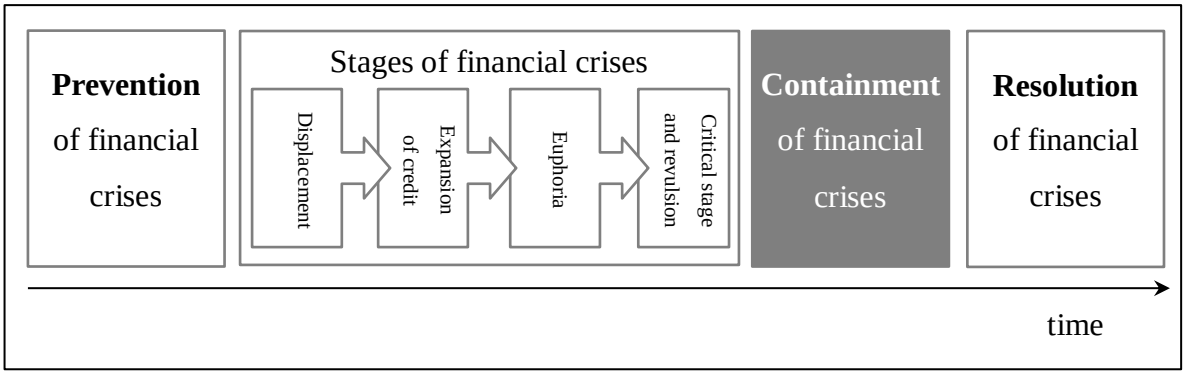


Figure 2-7: Categories of financial crises measures

Financial crisis measures are categorised according to their aim and occurrence. Crisis prevention looks to the future and seeks to reduce the risk of new crises. Financial crisis containment focuses on the present and seeks to let the financial system survive, and especially halt the outflow of money, bank runs and drops in asset prices (Gelpern, 2009). The actions are applied after phase four "critical stage and revulsion" of financial crises.

Financial crisis resolution refers to a long-term restructuring exercise in the aftermath of a financial crisis. Figure 2-7 visualises this delimitation.

The application of crisis containment actions, however, leads to a morally hazardous effect in the long-term. Interventions during a financial crisis make market participants feel assured of being rescued in future and, therefore, encourage them to behave as before (Claessens et al., 2010; Faure and Heine, 2013). Bagehot summarised that "any aid to a present bad bank is the surest mode of preventing the establishment of a future good bank" (Bagehot, 1873, p. 104). Empirical data confirms that countries, which received support are prone to follow policies conducive to crises (Bordo and Schwartz, 2000). The European Central Bank pointed out that during the last financial crisis arguments of moral hazard had not been accorded the highest priority (Singh, 2011). Calomiris et al. (2016) summarise that a balance is needed between the response to financial crises and pre-established rules that set limits on containment actions in order to reduce this moral hazard effect.

However, Ingves and Lind (2008) say that historical financial crises have taught us about the need for significant containment actions. Next to injured market participants, there are sectors that depend on external finance, which is hard to get during a financial crisis. They perform badly under such circumstances and, therefore, need support from policy makers (Dell' Ariccia et al., 2008).

The catalogue of discussed actions is highly diverse and the initiation of actions is spread across different institutions. LaBrosse and Singh (2013) say, traditionally, central banks, bank supervisors, government departments and other organisations, providing deposit protection, are seen as safety net players. In addition, shareholders, external auditors, courts and rating agencies might play a role. Scientists, such as Borio (2011); Singh and LaBrosse (2011); Singh (2011), advocate a holistic view on containment actions. Goodhart (2011) even claims a macro-prudential authority for financial crisis containment and Pisani-Ferry and Sapir (2010) and Gandrud and O'Keeffe (2016) highlight the need to share information among authorities.

Financial crises containment actions can be differentiated between those focussing on macroeconomic policy in terms of the markets and those focussing on microeconomics supporting individuals (Bandt and Hartmann, 2000). Macro-prudential actions aim to limit the costs to the economy. According to the macro-prudential approach individuals may only be supported if they are of systemic significance. The micro-prudential objective reduces the risk of default without distinction among individuals (Crockett, 2000). There are controversies regarding the categorisation of a lender of last resort. Bordo (1990) and Freixas et al. (1999) provide an overview. Some argue that the lender of last resort is associated with the provision of liquidity to individual parties (Goodhart and Huang, 2005; Singh, 2011) and, therefore, categorised as a micro-prudential action. Others see also monetary policies of central banks which are seen as macro-prudential actions as a part of the lender of last resort (Goodfriend and King, 1988; Wood, 2000). They argue that the lending is never to the market. It ends always at the account of an individual party and is, therefore, a lending to an individual party.

This section introduced aspects of financial crisis containment actions, along with the concept of complex systems and financial crisis, the third component of this research. The next chapter discusses the methodological approach adopted by this research.

3 Methodological considerations

This chapter shows the methodological approach of this research and describes the research activities, limitations, the research design as well as the applied techniques of complex systems and the approach to the historical evaluation. The results of this research are outlined in Chapters 5 and 6.

The first section explains the originality of this research and lists all research activities. The corresponding Appendix 7 links the literature of this research to all research activities.

The section "Research design" contains a philosophical view on the nature of knowing and describes the philosophy of the chosen complex system approach. In addition, the research approach is described and classified.

The third section describes the applied analytical techniques of complex systems, which was introduced, in general, in Chapter 2.1. The subsequent four sub-chapters describe the applied analytical techniques (i.e. sustainability of actions, systemic role of the elements, the impact of actions and the interferences).

Section four explains the background of the historical evaluation.

The last section focuses on the limitation of this research.

3.1 Originality of research, objectives and research activities

This first section explains the originality of the research and the research objectives, including all the research activities.

Originality of research

Research originality can be achieved in different ways. Phillips and Pugh (2005) provide a range of definitions of originality. This research is characterised by one of their definitions. It makes a synthesis of theories that has not been done before. Different theories (i.e. financial crisis, financial markets and financial crisis containment) are combined into one systemic financial crisis model in order to apply the systemic tool-set.

The aim of this research, the analysis and evaluation of financial crisis containment actions, is concretised by three research objectives and six research questions. Appendix 7 links them and the research activities to the literature of this research.

Research Objective 1:

To develop a systemic financial crisis model, existing theories about financial crises, financial markets and financial crisis containment have to be identified and transferred to a complex system view. The 23 research activities, required to develop such a model, are listed in Table 3-1.

Table 3-1: Research activities for Research Objective 1

#	Research activity	Chapter
1-1	Identification of systemic modelling and analyses options	2.1
1-2	Definition of financial crises	2.2.1
1-3	Description of stages of financial crises	2.2.2
1-4	Systemic modelling of the price theory	4.1.1
1-5	Systemic modelling of the asset price theory	4.1.2
1-6	Systemic modelling of credit leverage	4.2.1
1-7	Systemic modelling of creditworthiness	4.2.2
1-8	Systemic modelling of credit cash flow	4.2.3
1-9	Systemic modelling of principal payments	4.2.4
1-10	Identification of non-rational market behaviour	4.3.1
1-11	Systemic modelling of speculation	4.3.2
1-12	Systemic modelling of price correction mechanisms	4.3.3
1-13	Systemic modelling of herd behaviour	4.3.4
1-14	Systemic modelling of moral hazard	4.3.5
1-15	Systemic modelling of fraud	4.3.6
1-16	Identification of reasons for exuberated prices	4.4.1
1-17	Identification of consequences of over-indebtedness	4.4.2
1-18	Systemic modelling of contagion	4.4.3
1-19	Systemic modelling of bank runs	4.4.4
1-20	Definition of financial crisis containment actions	2.3
1-21	Identification of systemic consequences of central banks	4.5.1
1-22	Identification of systemic consequences of the lender of last resort	4.5.2
1-23	Identification of systemic consequences of governments and regulators	4.5.3

Research Objective 2:

To analyse financial crisis containment actions, analytical techniques of the complex system approach can be applied. This research objective contains five research questions that are linked to more detailed research activities (see Table 3-2). The results of this analysis are documented in Chapter 5.

Table 3-2: Research questions and research activities for Research Objective 2

#	Research question / Research activity
2-1	How effective are the crisis containment actions of central banks?
2-1-1	Analysis of the effectiveness of the extension of money supply
2-1-2	Analysis of the effectiveness of the increasing of general interest rate
2-1-3	Analysis of the effectiveness of the decreasing of general interest rate
2-1-4	Analysis of the effectiveness of the appreciation of domestic currency
2-1-5	Analysis of the effectiveness of the depreciation of domestic currency
2-1-6	Analysis of the effectiveness of asset purchases from markets
2-1-7	Analysis of the effectiveness of asset purchases from banks
2-1-8	Analysis of the effectiveness of the lightening of collateral requirements
2-2	How effective are the containment efforts of the lenders of last resort?
2-2-1	Analysis of the effectiveness of the provision of liquidity to banks
2-2-2	Analysis of the effectiveness of the provision of liquidity to financed investors
2-2-3	Analysis of the effectiveness of the provision of foreign liquidity to banks
2-3	How effective are the crisis containment actions of governments and regulators?
2-3-1	Analysis of the effectiveness of deposit insurances, guarantees and nationalisations
2-3-2	Analysis of the effectiveness of asset purchases programme
2-3-3	Analysis of the effectiveness of asset transfer programme
2-3-4	Analysis of the effectiveness of the debt moratoria for financed investors
2-3-5	Analysis of the effectiveness of the accounting discretion
2-3-6	Analysis of the effectiveness of deposit freezing or bank holidays
2-3-7	Analysis of the effectiveness of bank holidays on exchanges
2-3-8	Analysis of the effectiveness of stress tests
2-3-9	Analysis of the effectiveness of the prohibition of short sales
2-4	Which potential new containment actions might be effective?
2-5	Which combination of financial crisis actions causes interferences?

Research Objective 3:

To strengthen the results of the complex system analysis, a historical evaluation is applied, matching the success of historical financial market interventions with the results of the analysis of effective financial crisis containment actions. The linked research question and three research activities are shown in Table 3-3.

Table 3-3: Research questions and research activities for Research Objective 3

#	Research question / Research activity	Chapter
3-1	To what extent do the results of a complex system analysis of financial crisis actions conform to successful historical market interventions?	
3-1-1	Selection of financial crises	6.1.1
3-1-2	Collection of required information	6.1.2 to 6.1.7
3-1-3	Evaluation of historical information	6.2

This section specified the originality of this research and the research activities. The next pages outline the philosophical context of this research.

3.2 Research design

This section gives the details of the nature of knowing, the philosophy of complex system concepts and the research approach.

Chapter 3.2.1 explains the interplay of epistemology and ontology and the complex system-way of thinking about a research problem.

The section "Research approach and research classification" describes the phases of this research and links them to the research structure of Chapter 1.3. Next to other dimensions, the classification differentiates between empirical and theoretical research, positivism and phenomenology and deductive and inductive research.

3.2.1 Nature of knowing and complex systems philosophy

This section gives insights into the questions "Why research?", "What is knowledge?" and "What can we know?" for this research.

Why research?

Remenyi et al. (2010) raised the question "why research?". Their answers are two-fold. On the one hand, research is undertaken because of incomplete knowledge and, on the other hand, to improve and enable the accumulation of knowledge. Both, in the end, requires new knowledge. This research is aimed at adding knowledge. Theories of financial crises, financial markets and financial crisis containment are combined and transferred to a complex system view in order to identify effective actions.

Knowledge affects the philosophical branches of epistemology and ontology. Epistemology focuses on knowing. According to Greco and Sosa (1999) specific questions can be raised. On the next pages, the questions "What is knowledge?" and "What can we know?" will be discussed. Ontology is the science of being (Sullivan, 2012). Van de Ven (2007) says ontology focuses on the nature of things, while epistemology concentrates on how we generate knowledge about them. Both branches intersect in the second question "What can we know?".

What is knowledge?

Knowledge requires truth and belief. Hence, true things that are not believed in and things that are false irrespective of whether they are believed in or not are not knowledge (Feldman, 2003).[5] Table 3-4 summarises this definition.

Table 3-4: Conditions of knowledge
Source: Own illustration basing on a summary of Feldman (2003)

	Belief	**Denial**
Something is true	**Knowledge**	No knowledge
Something is false	No knowledge	No knowledge

In addition to truth and belief, knowledge needs justification. Proper conclusions are justified when they are drawn from justified true beliefs. A properly drawn conclusion is not justified when it is derived from a false belief (Feldman, 2003). Albert Einstein added the perspective of time. He suggested that "scientifically acquired and tested knowledge is not knowledge of reality, it is knowledge of the best description of reality that we have at that moment in time" (Checkland, 1981, p. 50). This aspect is crucial for the systemic

[5] The truth of knowing is the purpose of the disciplines criteriology and epistemology. While criteriology investigates the criteria of truth epistemology studies the nature of knowledge (Sullivan, 2012).

modelling of financial crises. More theories might be developed in future that could alter the developed financial crisis model. New elements or interrelations can be added or existing elements or interrelations changed or deleted.

What can we know?

Knowledge can be classified according to its assumption on the existence of universal knowledge (Sullivan, 2012). Table 3-5 shows the basic philosophies.

Table 3-5: Philosophies of universal knowledge
Source: Own illustration based on Sullivan (2012)

Universal knowledge	Philosophy
is real	Absolute realism: Universal knowledge is real and exists on its own
is mind-based and real	Moderate realism: Universal knowledge exists in the mind but as individual knowledge in reality
is mind-based	Conceptualism: Universal knowledge exists in the mind only
is not existent	Nominalism: There is neither any universal knowledge in mind nor in reality

There are several overviews and terms (e.g. pragmatism or relativism) considering additional dimensions (see Avenier and Thomas (2013) and Van de Ven (2007)). However, the complex system philosophy is closely linked to mind-based concepts. It is a way of thinking about a problem but is not itself a discipline (Checkland, 1981; Hooker, 2011; Laszlo, 1984). A complex system approach integrates other (mind-based) models describing the experienced world ("first-order" models). [6] A complex system approach might be classified as a "second-order" model (Jaccard and Jacoby, 2010; Laszlo, 1984).[7] Figure 3-1 depicts this complex system philosophy.[8] Complex system models, therefore, do not have a direct relation to the experienced world. The inputs are mind-based, first order models. Therefore, the output of complex systems can only be mind-based.

[6] Some complex system concepts (e.g. Checkland (1981)) identify elements and interrelations by interviewing relevant parties.

[7] Wallis (2010) describes a similar concept but uses the term metatheory.

[8] The terms "first order" and "second order" have an additional meaning. Umpleby (2005) summarised that first order cybernetics focus on the observation of systems and interactions between variables. Second order cybernetics concentrate on the interaction between the observer and observed systems.

In this research, the transfer of first-order models into a second-order model can be seen as qualitative research. Words describing causalities are transformed into elements and interrelations. Different first-order models have to be combined, which do not have the same level of information. Detailed information need to be aggregated and high level information have to be detailed. The approach to develop the financial crisis model is visualised in Figure 4-16 on page 126.

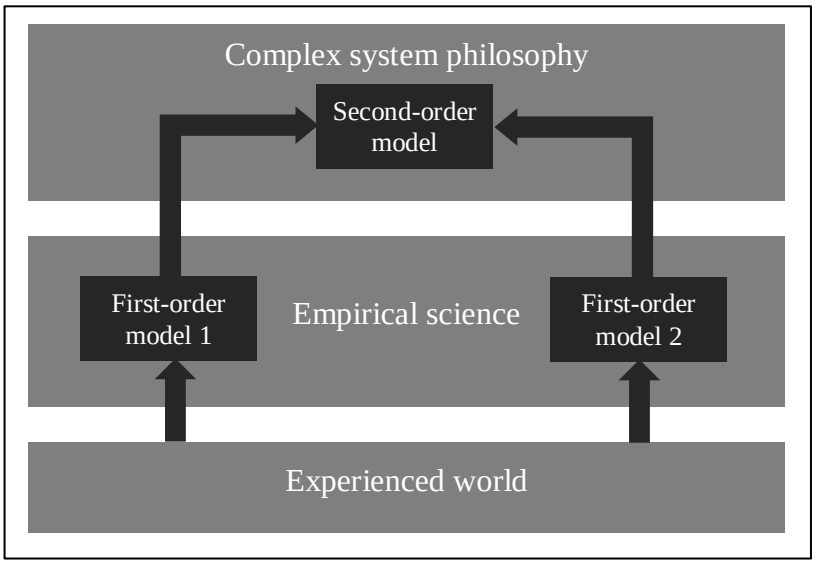


Figure 3-1: Complex system philosophy
Source: Adaptation from Laszlo (1984)

The complex systems philosophy is an interdisciplinary approach to study a specific theme (Blauberg et al., 1977). Interdisciplinary work is characterised by the transfer of theories from various fields of science to a specific question (Brand, 2004).

This section described the philosophical implications of this research. The next part of the thesis provides details of the research approach and research classification.

3.2.2 Research approach and research classification

This section starts with a description of the two different phases of this research and classifies them in accordance with a range of research dimensions.

This research approach is split into two phases. The first phase contains the first three steps of the research structure (see Chapter 1.3) and two research objectives (see Chapter 3.1).

This phase transforms theories about financial crises, financial market and financial crisis containment actions into a systemic financial crisis model. The subsequent analysis of this model leads to prioritisation of containment actions. Therefore, the first phase can be seen as rationally inspired theoretical modelling. The rationale comes from the existing literature. The second phase of this research seeks to strengthen the outcome of the first phase by an ex-post empirical evaluation. This phase is identical to Step 3 of the research structure (see Chapter 1.3) and to the Research Objective 3 (see Chapter 3.1). The results of the of the first phase answers the Research Questions 1, 2, 3, 4 and 5 and the Research Question 6 by the second phase (for details please refer to Chapter 3.1). Figure 3-2 visualises the research approach taking into account the questions recommended by Remenyi et al. (2010) "why research?", "what to research?" and "how to research?".

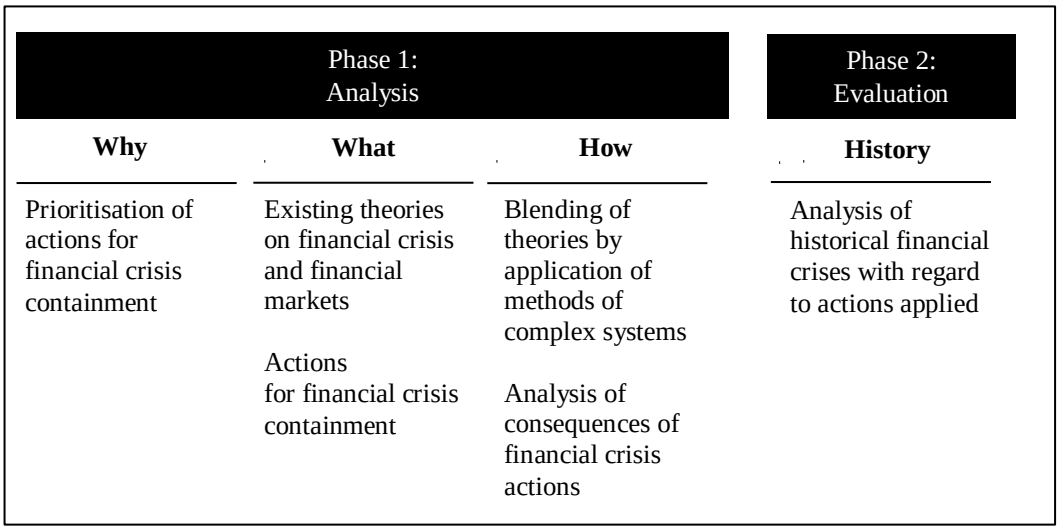


Figure 3-2: Research approach

Research in business and management emphasises the application of knowledge to find solutions to practical problems (Remenyi et al., 2010). Normally, applied research focuses on real-world problems that are narrow in scope, while basic research is characterised by a broad scope without pressing problems (Jaccard and Jacoby, 2010). The first phase of this research mixes the research strategies of applied research and basic research. A complex system approach relies on a broad scope to consider interrelations between elements characterising basic research but focuses on real-world problems. The second phase of this research contains an evaluation of the results of the first phase and is, therefore, not separately categorised.

Research can either be empirical or theoretical. Empirical research is strongly dependant on observations and experiments, while a theoretical researcher usually does not have any direct involvement in observations and gathering evidence. The majority of academic research is empirical in nature (Remenyi et al., 2010). Even the missing dimension of theoretical versus empirical research in the research process onion of Saunders et al. (2000) indicates the rarely chosen theoretical research approach in business studies. In fact, some scientists argue that conceptual systems are not scientific as long as they are not empirically verified or falsified (Jaccard and Jacoby, 2010). However, research might be performed by studying the subject through publications of others and having a different view on the situation. Theoretical research is characterised by a new interpretation of the findings of previous empirical research (Remenyi et al., 2010). The initial phase of this research can be categorised as theoretical research. Different theories of other scientists form the basis for this phase. The second phase of this research collects historical information about financial crises from other writers. This second phase cannot be precisely categorised. Evidence from the past, normally linked to empirical research, is collected, but since the research is without its own observations and experiments, it could be seen as theoretical research.

There are two major options within the empirical research. A positivist works with an observable social reality and derives laws or law-like generalisations. The positivism is linked to falsification, which means a proposition cannot be proved but it can be proved to be false (Remenyi et al., 2010). Popper (2002), who strongly recommended the approach of empirical research, emphasised the importance of the falsification of theories in a scientific environment. Normally, scientists try to falsify theories as much as possible. However, a price has to be paid for studies applying a complex system approach. They cannot falsify theories. They explain phenomena (Hayek, 1967) and provide deeper insights. In contrast, the phenomenological approach sees each situation as unique (Remenyi et al., 2010). The first phase of this research is driven by theoretical research. Therefore, a classification in terms of positivism or a phenomenological approach is not possible. The second phase of this research can be seen to be positivistic. The results of the first phase are evaluated by historical information. However, they are not falsified.

Scientific research might be deductive or inductive. Deductive research starts with a hypothesis. An empirical enquiry tests the hypothesis that might be strengthened by the outcome. In contrast, inductive research starts with the collection of information. The subsequent interpretation leads to the development of a theory (Saunders et al., 2000). The first phase transforms a range of theories into a systemic financial crisis model. The analysis of this model creates data that allows the analysis of the effectiveness of financial crisis containment actions. Therefore, the first phase might be classified as inductive research. The second phase of this research seeks to strengthen the prioritisation of the first phase. Information about historical financial crises actions serves as the basis for the matching. Therefore, the second phase can be seen as deductive research.

Research can have a longitudinal or a cross-sectional time horizon. Longitudinal research focuses on changes over time to identify trends. Cross-sectional research concentrates on one point in time and examines differences of populations (Remenyi et al., 2010). The first phase of this research does not contain any empirical data. Therefore, the first phase cannot be classified to be of that nature. The second phase focuses on differences of financial crises that can be categorised as cross-sectional research despite the fact that financial crises happened in different points in time. The analysis of sequences of containment were out of scope. Otherwise, it would have been also categorised as longitudinal research.

Research might be quantitative or qualitative. While quantitative evidence contains numbers, qualitative evidence can be described in words (Remenyi et al., 2010). Both parts of the research are based on qualitative evidence but uses quantitative analysis techniques. The first part of this research derives data from theories of other writers (see Chapter 3.2.1). Those transformations are the basis of a complex systems approach (Laszlo, 1984). The analytical techniques of the complex system approach is quantitative research (see Chapters 3.3.2, 3.3.3 and 3.3.4). The second phase of this research selects historical samples published by other scientists. Owing to a limited number of samples, only a limited statistical analysis could be done.

Narrative thinking constructs a consistent description of a subject. In contrast, paradigmatic thinking tries to derive laws from observations (Remenyi et al., 2010). The first part of this research follows a narrative thinking. Different theories are blended into a

systemic model to describe financial crises. The second phase is more paradigmatic in nature. Historical observations are studied to strengthen the results of the first phase.

Theories are generally classified as descriptive, relational or explanatory. Descriptive theories describe or classify dimensions or characteristics by observations. Relational theories specify the relation among dimensions or characteristics. Explanatory theories focus on the relationship between different groups. Historical research is one of the non-empirical observational techniques of relational theories (Fawcett and Downs, 1986). The first phase of this research combines various aspects, which can be classified as explanatory theory. The second phase of this research collects historical information to classify financial crises according to their actions of financial crisis containment and can, therefore, be seen as relational.

The following table summarises the described classification of both phases of this research.

Table 3-6: Classification of this research

Phase 1	Phase 2
Problem-oriented	n/a
Broad scope	n/a
Theoretical research	Empirical research
n/a	Positivism
Inductive research	Deductive research
n/a	Cross-sectional time horizon
Qualitative data collection methods	Qualitative data collection methods
Quantitative data analysis methods	Quantitative data analysis methods
Narrative thinking	Paradigmatic thinking
Explanatory research	Relational research

This section illustrated the phases of this research and their classification. The next section deals with the applied techniques to analyse the developed system.

3.3 Analytical techniques of complex systems

This section explains the applied techniques of the complex system approach.

The first sub-chapter shows basic assumptions of the modelling approach that are introduced in a generalised manner in Chapter 2.1. In particular, it defines the way of modelling of interrelations and the handling of time delays.

The four sub-chapters 3.3.2 to 3.3.5 describe the analytical techniques. The sustainability of actions is measured by the counting cycles of the system and the strength of actions is linked with the systemic role of elements, classifying them by their ingoing and outgoing interrelations. The impact of actions is determined by paths from elements that are influenced by relevant actions to elements that are linked to desired key goals. Interferences of actions are identified by analysing the cumulative effects of actions in order to find the combinations without negative effects on key goals.

3.3.1 Concept of the developed systemic analyses

This section clarifies assumptions of the systemic modelling. The basic concepts of complex systems were introduced in Chapter 2.1. The next pages start by explaining the handling of interrelations and time delays, the interplay of actions and potential new actions with the system and naming the used analysis software.

There are different concepts for modelling the intensity of interrelations. The simplest modelling approach does not differentiate the intensities of interrelations. In this case, the adjacency matrix would be almost identical to the impact matrix. The impact matrix, however, would not only contain the values of 0 or 1. Negative interrelations are modelled by the value -1. A more advanced method is the differentiation between weak, standard and strong interrelations allowing the application of the systemic analysis techniques of Vester (2007) and Ulrich and Probst (1991). This concept is applied for this research.

The effects of interrelations between elements can be delayed. There are different representatives of soft modelling concepts (see Chapter 2.1.1). Basically, soft modelling concepts allow the modelling of this aspect but not all representatives consider time delays. Normally, all interrelations involve some delay. There is a special aspect in case of financial markets. One of the basic assumptions is that of an efficient market hypothesis. Owing to a large number of rational market participants, financial markets can be seen as almost perfect economic markets and every bit of information is reflected in prices even future developments. Badly informed market participant are arbitraged by competition (see Chapter 4.1.2). It can be assumed, therefore, that no time delays exist for financial markets. An exclusion of time delays influences the analyses of the sustainability and the impact of actions in one dimension. The majority of analyses are based on the adjacency and the

intensity matrices and do not need the dimension of time delays (see Chapters 3.3.2, 3.3.3 and 3.3.4). Brand (2013) considers the factor time delay in his concept and describes additional analyses. The duration of effects would be taken into account. Cycles and paths with less time delays could be interpreted as having a more intense effect.

All actions can be linked to existing elements within the system. Actions that add, change or delete interrelations or add or delete elements causing structural changes are not considered in this research. Additional analyses would be required for that. Instead of an analysis within the system, different systems need to be compared.

The analysis contains actions already mentioned in literature. In addition, this research seeks to identify potential new actions. All remaining elements of the developed system not linked to identified actions are also within scope of the analysis.

The analyses were performed by the computer algebra system *Mathematica* developed by Wolfram Research. It allows a broad range of technical computing, including networks, images, geometry, data science and visualisation. The initial release was 27 years ago. A student edition with the version 9.0.1.0 has been used for this research. Some graphics has been created with help of *Microsoft Excel 2010*.

This section defined basic assumptions of the systemic modelling. The next sections give insights into the analysis techniques.

3.3.2 Sustainability of actions

The sustainability of actions is examined in the first investigation. The results of the applied techniques for financial crisis containment actions are dealt with in Chapter 5.1. This section explains the background and the goal of the analysis, describing in detail how cycles ate identified and enumerated. The length of the cycles can influence the results. The handling of this aspect and the ways of identifying more important elements in cycles are outlined at the end of this section.

Background and goal of the analysis

For this research, the term "sustainability" describes a characteristic of an action. An action can be seen as sustainable if an intended effect of an action is repeated without the initiation of new actions.

Elements are interrelated and cycles[9] show the interrelations of an element with itself. Elements may be classified according to their involvement in cycles. A positive cycle amplifies an initial impulse and a negative cycle neutralises an initial impulse.

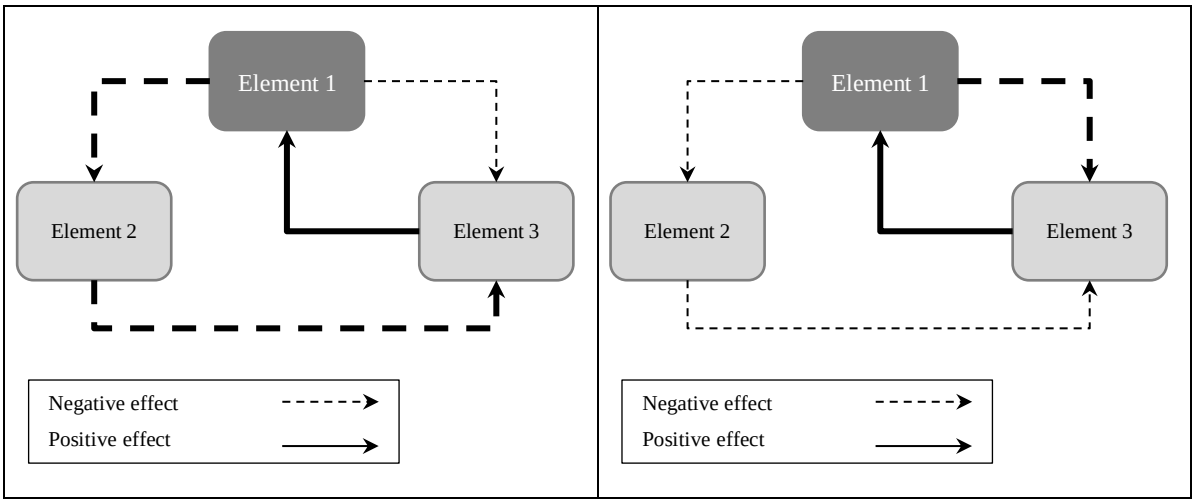


Figure 3-3: Example of the analysis of sustainable actions

Figure 3-3 shows two identical systems with three elements and four interrelations. Actions should be initiated through Element 1, which is highlighted in dark grey. Actions to increase Element 1 cause two cycles. First, an increase of Element 1 decreases Element 2, which increases Element 3 and, finally, increases Element 1 (left graphic). Second, an increase of Element 1 decreases Element 3 causing a decrease of Element 1 (right graphic).

Method: Enumeration of cycles

Positive and negative cycles can be identified by counting the number of negative interrelations in the chain of interrelations of the cycle. An even number of negative interrelations indicates a positive cycle. An initial impulse is reversed and re-reversed again. An odd number of negative interrelations indicates a negative cycle. Self-loops are not considered on the chain of interrelations.

[9] The term „feedback loops" can be used as a synonym.

Elements with a dominance of positive cycles are sustainable. An intended effect is repeated in every iteration without the effort of triggering a new action. An action is not sustainable if a linked element is not involved in the cycles or in case of existing negative cycles. An intended effect is not repeated in the second iteration.

The differentiation followed the criteria below.

- Actions can be seen as sustainable if there are more of positive cycles compared to negative cycles. The initial impulse would be amplified.[10]
- Actions are unsustainable if positive and negative cycles are equally distributed. The initial impulse would not be amplified.
- Actions are unsustainable if there are a greater number of negative cycles. The initial impulse would be neutralised.

The example given in Figure 3-3 can be seen as unsustainable. Positive and negative cycles are equally distributed.

The identification of cycles in a directed graph is a hard mathematical problem. The greater the number of elements and interrelations in a system, the greater is the difficulty in counting them (Brand, 2013). Skates (2013) programmed an algorithm in the computer algebra system *Mathematica*, which was used for the analysis.

Method: Length of cycles

The lengths of both identified cycles in Figure 3-3 are different. The first positive cycle 1→2→3→1 has a length of three interrelations. The second negative cycle 1→3→1 is shorter.

From an analytical point of view, longer cycles do not have the same intensity as shorter ones. In the long run, shorter cycles have immediate effects (Vester, 2007). The lengths of the cycles can be categorised by the following criteria:

[10] In order to highlight elements with a dominance of positive cycles, it has been differented between sustainable and slightly sustainable. In case of 5% or more of positive cycles compared to negative cycles, the element is categorised as sustainable. Owing to the analysis of the data set, a threshold of 5% has been identified as a suitable value. Lower thresholds would lead to more action with a classification of sustainable.

- More positive cycles with shorter lengths compared to negative cycles can be seen as being sustainable. The initial impulse would be amplified.
- More negative cycles of shorter lengths compared to positive cycles can be seen as being unsustainable. The initial impulse would be neutralised.
- Equally distributed lengths of positive and negative cycles have no effect on sustainability. The initial impulse would be neither amplified nor neutralised.

A differentiation is made if the ratio of the mean of longer and shorter cycles has a difference of more than 10% (based on higher values and rounded numbers).[11]

Figure 3-3 shows a shorter negative cycle that can be interpreted as an unsustainable effect.

Method: Involvement of elements in cycles

The system shown in Figure 3-3 reveals that Element 3 is involved in two cycles and that Element 2 is involved less often, but exclusively, in positive cycles.

This aspect of sustainability strives to analyse the identified cycles. Involved elements are categorised according to their involvement in positive or negative cycles (Vester, 2007).

- Elements that are mostly involved in positive cycles are more important to amplify the initial impulse.
- Elements that are mostly involved in negative cycles are more important to neutralise the initial impulse.
- Elements that are almost equally involved in positive and negative cycles have no effect on the sustainability of the analysed element.

A differentiation is made if there are more or less than 10% of positive cycles compared to all cycles.[12]

[11] The goal of this analysis is a categorisation of elements according their lengths of cycles. In order to achieve a clear distinction, an additional threshold is required. Owing to the analysis of the data set, a relative threshold of 10% has been identified as a suitable value. Lower thresholds would lead to more changed classifications due to the length of cycles.

[12] The goal of this analysis is a categorisation of elements according their involvement in cycles. The data set contains elements with many cycles but also elements without a large number (sometimes 155 positive cycles are compared to 157 negative cycles [Cycles of Element 28 – Element 3 "Asset price"] and sometimes 4 positive cycles are compared to 5 negative cycles [Cycles of Element 25 – Element 6 "Asset risk-return ratio"]. In order to achieve a clear distinction, an additional threshold is required. A significance is not considered if it is based on a small number of cycles. Owing to the analysis of the data set, an absolute threshold of 30 cycles has been identified as a suitable value. Lower thresholds either for the relative threshold or the absolute threshold would lead to more identified involved elements.

Figure 3-3 shows that Element 2 plays an essential role in amplifying effects.

This section showed the approach to assessing the sustainability of actions. The next part of the thesis explains the approach to determine the strength of actions.

3.3.3 Systemic roles of elements

The strength of actions shall be identified in the second investigation. The results of the applied techniques for financial crisis containment actions are dealt with in Chapter 5.2. This section explains the background, the goal and the method of analysing the systemic role of elements.

Background and goal of the analysis

Elements may be classified according to their ingoing and outgoing interrelations. Elements with a large number of outgoing interrelations have a higher impact on the system. They can be seen to be more powerful. Elements with a large number of ingoing interrelations indicate changes within the system (Brand, 2013; Ulrich and Probst, 1991; Vester, 2007).

This analysis strives to classify elements in order to identify the powerful elements in a system.

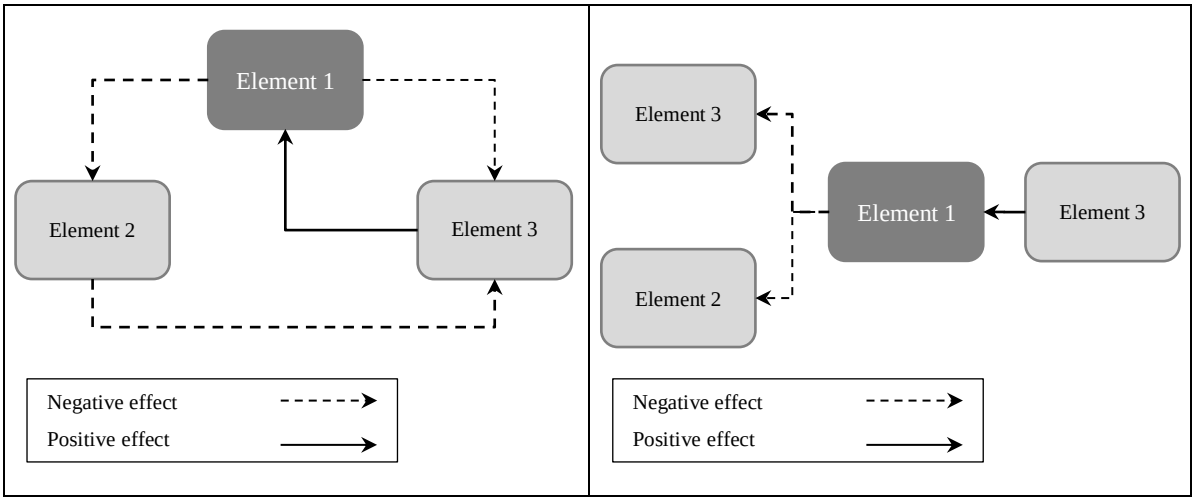


Figure 3-4: Example of the analysis of systemic roles of elements

Figure 3-4 shows a system with three elements and four interrelations. Actions should be initiated through the specific Element 1, which is highlighted in dark grey. The left graphic shows the system. The right graphic highlights the ingoing and outgoing interrelations of Element 1. The example contains two outgoing interrelations and one ingoing interrelation (Element 3 is linked as a ingoing and an outgoing interrelation).

Method

Vester (2007) developed an advanced method of assessing ingoing and outgoing interrelations. Instead of their simple numeration, the method weighs the number of interrelations with their intensity. The active sum describes the sum of outgoing interrelations and the passive sum that of ingoing interrelations.

Vester developed his concept in the seventies and eighties of the twenty century. Ulrich and Probst (1991) adapted Vester's interpretation scheme to a four-field-matrix.

- High active sums and low passive sums define an active element.
- High active sums and high passive sums define a critical element.
- Low active sums and low passive sums define a buffering element.
- Low active sums and high passive sums define a passive element.

Only active elements can be seen as powerful without risking over-regulation of the system. Actions should be initiated though active elements (Ulrich and Probst, 1991; Vester, 2007).

Figure 3-5 visualises this classification.

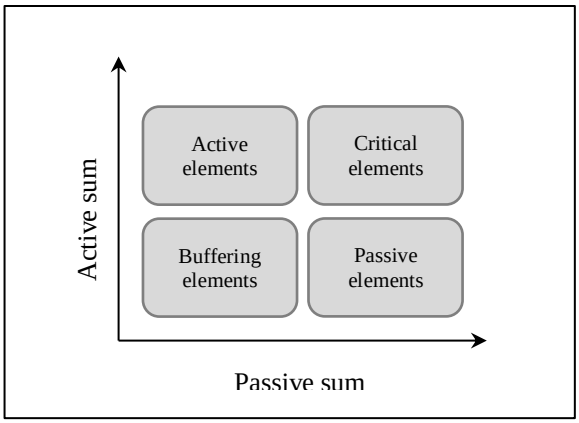


Figure 3-5: Roles of elements

The thresholds are calculated by half of the higher sum (either of the active sum or the passive sum). Elements, meeting the threshold, are classified into the lower category. This means that elements with an active sum of half of the higher sum are classified into a low active sum and elements with a passive sum of half of the higher sum are classified into a low passive sum.

This section described the analysis to identify powerful actions. The next pages introduce the way to measure the effects of actions.

3.3.4 Impact of actions

The previous sections explained the methods of analysing the sustainability and strength of actions. However, sustainable and powerful actions do need to have a positive effect during financial crises. A third investigation is required to identify the impact of actions on specific key elements of the financial crisis model. The results of the applied techniques for financial crisis containment actions are dealt with in Chapter 5.3. This section explains the background and the goal of the analysis and describes the detailed approach to path identification and enumeration. The length of paths can influence the results. The handling of this aspect and the ways to identify the more important elements in paths are described at the end of this part of the thesis.

Background and goal of the analysis

Paths show the interrelation of one element with a specific element. Within the developed systemic financial crisis model, some elements are more important than others. During financial crises, the containment actions seek to prevent the outflow of money, bank runs and drops in asset prices (Gelpern, 2009). Therefore, the Elements “Assets price”, “Liquidity of banks” and “Foreign exchange rate” are seen as key elements indicating the survival of the system. All actions are analysed with regard to their effects on those key elements.

Elements with a dominance of positive paths to one of the key elements indicate that an initial impulse is directly transferred. An increase (decrease) of the source element increases (decreases) the receiving element. Elements with a dominance of negative paths

indicate that the initial impulse is reversed. An increase (decrease) of the source element decreases (increases) the receiving element.

This analysis strives to identify actions whose linked elements have supportive effects on the key elements of the system.

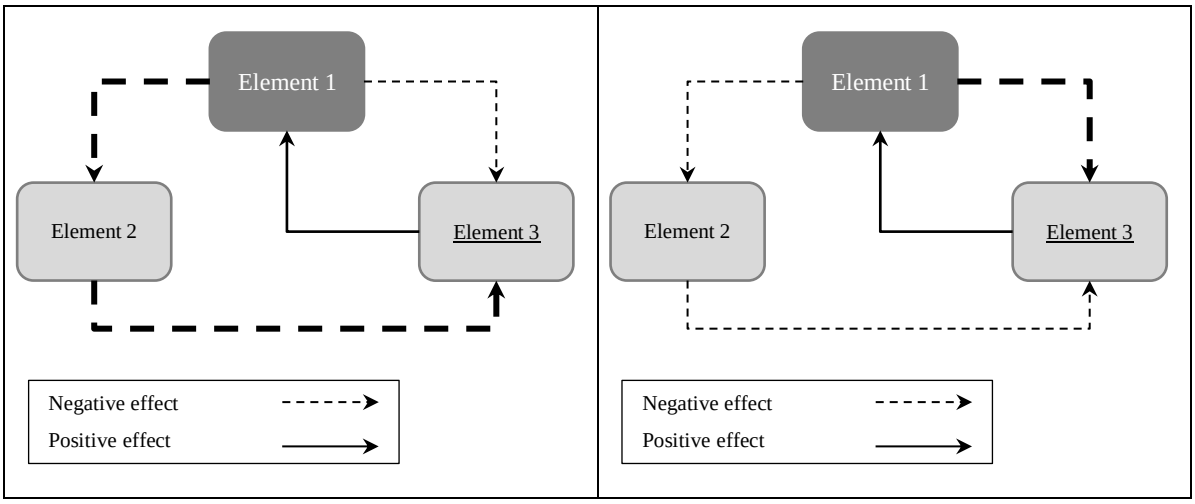


Figure 3-6: Example of the analysis of impact of actions

Figure 3-6 shows two identical systems with three elements and four interrelations. Actions should be initiated through Element 1, which is highlighted in dark grey. Actions should impact the underlined Element 3. There are two paths from Element 1 to Element 3. First, an increase of Element 1 decreases Element 2, which increases Element 3 (left graphic). Second, an increase of Element 1 decreases Element 3 directly (right graphic).

Method: Enumeration of paths

The identification of paths between elements is a key result of the systemic analysis (Brand, 2013). Positive and negative paths can be identified by counting the number of negative interrelations in the chain of interrelations of the path. An even number of negative interrelations indicates a positive path. An initial impulse is reversed and re-reversed again. An odd number of negative interrelations indicates a negative path. Self-loops are not considered on the chain of interrelations.

The differentiation followed the criteria below.[13]

[13] In order to highlight elements with a dominance of positive or negative paths, it has been differented between normal and slight effects. In case of 5% or more of positive (negative) paths compared to negative (postive) paths, the effect is categorised as normal

- The initial impulse would be directly transferred from one element to another if more of positive paths exist compared to negative paths.
- Actions do not have an impact if positive and negative paths are equally distributed.
- The initial impulse would be reversed if more of negative paths exist compared to positive paths.

The example given in Figure 3-6, which shows two paths from Element 1 to Element 3, does not have any impact. Positive and negative paths are equally distributed.

The analysis contains the enumeration of positive and negative paths in the system. Cycles are not considered. They are separately analysed (see Chapter 3.3.2). The basis algorithm was programmed by experts of the *Mathematica* community StackExchange (2014).

Method: Length of paths

The lengths of both identified paths in Figure 3-6 are different. The first positive path 1→2→3 has a length of two interrelations. The second negative path 1→3 is shorter.

From an analytical point of view, longer paths do not have the same intensity as shorter ones (Vester, 2007). The lengths of the paths can be categorised by the following criteria:

- More positive paths with a shorter length compared to negative paths can be seen as being more intensive in the direct transfer of the initial impulse.
- More negative paths of shorter lengths compared to positive paths can be seen as being more intensive in reversing the initial impulse.
- Equally distributed lengths of positive and negative paths have no effect.

A differentiation is made if the ratio of the mean of longer and shorter paths has a difference of more than 10% (based on higher values and rounded numbers).[14]

Figure 3-3 shows that the path with a reversing effect is shorter. This can be interpreted as an overall reversing effect.

otherwise as slight. Owing to the analysis of the data set, a threshold of 5% has been identified as a suitable value. Higher thresholds would lead to more actions with a classification of slight effects.

[14] The goal of this analysis is a categorisation of elements according their lengths of paths. In order to achieve a clear distinction, an additional threshold is required. Owing to the analysis of the data set, a relative threshold of 10% has been identified as a suitable value. Lower thresholds would lead to more changed classifications due to the length of paths.

Method: Involvement of elements in paths

The system shown in Figure 3-6 reveals that Element 1 and Element 3 are involved in two paths and that Element 2 is involved less often, but exclusively, in positive paths.

This analysis strives to assess the identified paths. Involved elements are categorised according their involvement in positive or negative paths .

- Elements that are mostly involved in positive paths are more important for directly transferring the initial impulse.
- Elements mostly involved in negative paths are more important to reverse the initial impulse.
- Elements that are almost equally involved in positive and negative paths have no effect.

A differentiation is made if there is more or less than 10% of positive paths compared to all paths.[15]

Figure 3-6 shows that Element 2 plays an essential role in the direct transfer of the initial impulse.

This section provided the details of how the impact of each action is determined. The next section explains the approach to find a combination of actions with positive effects.

3.3.5 Interferences of actions

Different independently applied actions might neutralise each other. This analysis tries to identify actions that have exclusively positive effects on key elements of the developed system. The results of the applied techniques for financial crisis containment actions are dealt with in Chapter 5.5. This section explains the background, the goal and the method of this analysis.

[15] The goal of this analysis is a categorisation of elements according their involvement in paths. The data set contains elements with many paths but also elements without a large number (sometimes 227 positive paths are compared to 221 negative paths [Paths from Element 20 to Element 19 – Element 19 "Liquidity of banks"] and sometimes 6 positive paths are compared to 3 negative paths [Paths from Element 12 to Element 19 – Element 24 "Creditworthiness of banks"]. In order to achieve a clear distinction, an additional threshold is required. A significance is not considered if it is based on a small number of paths. Owing to the analysis of the data set, an absolute threshold of 30 paths has been identified as a suitable value. Lower thresholds either for the relative threshold or the absolute threshold would lead to more identified involved elements.

Background and goal of the analysis

Scientists advocate a holistic view on financial containment actions. The intended effect of actions might be neutralised by other actions.

This analysis strives to identify recommendable combinations of actions to achieve an intended impact on defined key elements of the developed financial crisis model.

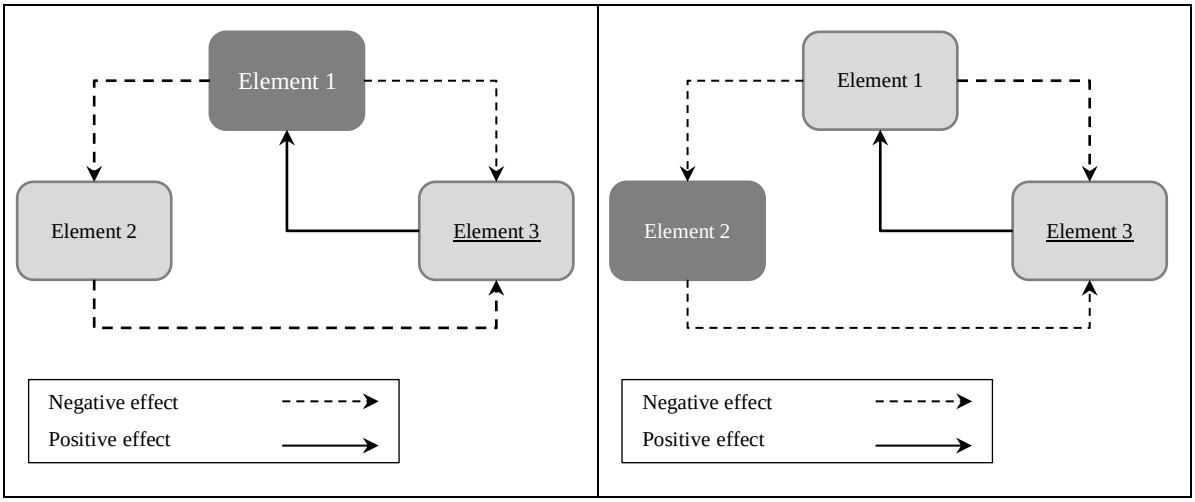


Figure 3-7: Example of the analysis of interferences of actions

Figure 3-7 shows two identical systems with three elements and four interrelations. Actions should be initiated through Element 1, which is highlighted in dark grey in the left graphic and through Element 2, which is highlighted in dark grey in the right graphic. Both actions should impact the underlined Element 3. There are two paths from Element 1 to Element 3 and one path from Element 2 to Element 3. An increase of Element 1 decreases Element 3 directly and decreases Element 2, which increases Element 3. An increase of Element 2 decreases Element 3 directly.

Method

This analysis matches the impact of each action on specific elements (see Chapter 3.3.4) and identifies the combination of actions that do not neutralise their actions. Actions without effects can be added to the list of recommendable combinations.

Figure 3-7 shows that the impacts of the two simultaneously applied actions are not consistent. Element 1 has no specific effect on Element 3, as revealed by the distribution of positive and negative paths. They are identical. However, the negative path is shorter than

the positive path. This higher intensity leads to an overall reverting effect of Element 1 on Element 3. Element 2 has a reverse effect on Element 3. A combination of both actions (increasing of Elements 1 and 2), should cause a decrease in Element 3.

This last section explained the fourth analysis, the identification of interferences, of the complex system approach. The next pages look at the methods of the second phase of this research, the historical evaluation.

3.4 Methods of the historical evaluation

The main focus of this research is the systemic analysis of financial crisis containment actions that is described in the preceding section. The aim of the deductive part of this research is to strengthen its results. This section specifies the approach. It briefly describes the goal of the analysis, the approach to data collection and data analysis.

As a first step, the applied financial crisis containment actions are identified for each selected historical financial crisis. In addition, criteria are defined to indicate a successful handling of financial crises. A high degree of conformity among the results of the analysis of effective containment actions and successfully handled crises may strengthen the results of the complex system approach. This would happen if either more applied recommended actions or less applied not-recommended actions seem to have positive effects on the defined indicators. Chapter 6.1.1 contains the reasons for the selection of financial crises, Chapters 6.1.2 to 6.1.7 show the collected information for each crisis and the results of the evaluation is dealt with in Chapter 6.2.

The core problem of this part of the research is the limited availability of public information about applied financial crisis containment actions during historical financial crisis. For a historical financial crisis, a complete data set that includes the entire list of applied containment actions and information about effects on indictors (i.e. asset prices, the liquidity situation of banks and the foreign exchange rate) is required. This information is available for financial crises described in Chapter 6. The collected information is gathered from different publications. The relevant information is partly contained in tables or sometimes just as single bits of information within texts. The source of information is always mentioned in Chapter 6. Nevertheless, single nuggets of information are missing

even for well documented financial crises. The action 2-2 “Provision of liquidity to financed investors” is rarely mentioned in the description of containment activities during financial crises. In this case, it is assumed that the containment action had not been performed. If conflicting information about the application of actions exist, it is assumed that the action had been performed.

A sufficient size of historical crises is required to apply statistical robustness tests. The results of the complex system approach (number of recommended actions or the number of not recommended actions) could be matched with indicators of a successful handled crisis (see Chapter 6.1.1). However, the available statistical tests could bot be applied because of the limited number of data pairs. For instance, Spearman's Rho requires a minimum number of six data pairs (Sachs, 1992), thus a complete data set for six financial crises have to be available. But the significance is limited even then. Therefore, instead of statistical tests, simple quantitative analyses describing the underlying data were performed in this research.

The last section described the general approach of the historical evaluation. The next section deals with the limitations of this research.

3.5 Limitation of this research

The limitations of this research are threefold. They are related to the research approach, the developed model and the historical evaluation.

The developed systemic financial crisis model based on the transformation of identified theories about financial crises, financial markets and financial crisis containment. It combines separate aspects into a “big picture”. However, this research approach can be seen as theoretical research and does not create new theories derived from the experienced world but provides deeper insights into the phenomena of financial crisis containment.

The developed model can be applied to currency areas meeting the assumptions of the developed model (see Chapter 4.6.5). Therefore, the scope of currency areas that can gain from the outcome of this research might be limited.

The small number of historical financial crises influences the interpretation of the outcome of the second part of this research. It cannot falsify the results of the first phase. Identified positive effects on the indicators might be caused either by more applied recommended actions or less applied not-recommended actions. But this relation cannot be tested. Hence, other influencing factors might be responsible for the trend. More data sets are required for an extended statistical analysis to clarify those relations.

This last section showed the general limitations of this research approach and the research activities, philosophical aspects of the research design and the applied quantitative methods of the first and the second phases of this research. The next chapter introduces theories about financial crises, financial markets and financial crisis containment in order to develop a systemic financial crisis model.

4 Exposé of relevant theories and their consideration for the systemic modelling

This chapter shows components of the financial crisis model and provides insights into financial crisis containment actions. Both are the basis for an analysis of the actions from a systemic point of view. In particular, this chapter realises likely consequences of the interrelationship between and across relevant aspects of financial crises, financial markets and containment actions.

This chapter is structured by the different stages of a financial crisis, explained in Chapter 2.2.2, and the containment actions. The relevant theories are described and causalities are transformed into a complex system view with elements and interrelations. Financial crises start with the displacement of attractive assets (Chapter 4.1), followed by an extension of financed investments (Chapter 4.2) and euphoria (Chapter 4.3) before the critical stage and revulsion (Chapter 4.4) begins. The complex system approach allows the extension of this financial crisis framework. Theories about financial markets and financial crisis containment (Chapter 4.5) extend the financial crisis model. The entire complex system is summarised, visualised and mathematically described in Chapter 4.6.

4.1 Displacement

This section describes the first stage of financial crises. The attractiveness of assets is often initially created by new technology (Kindleberger and Aliber, 2005; Roubini and Mihm, 2011) or financial liberalisation (Allen and Gale, 2000). However, Summers (2000) highlights that, in the end, the beginning of financial crises is characterised by an increased supply of and decreased demand for assets.

The basic price relations are described in the section “Prices”. The general price building process of assets considers additional aspects. They are outlined in the section “Asset price theory”.

4.1.1 Prices

Basically, economic theory says that the market price of a product is created by its demand and supply. A high product demand raises its prices. In contrast, more supply of a product causes price drops (Ison and Wall, 2007). Sterman (2014) shows the systemic modelling of these causalities.

Interrelation 1:

Greater asset demand increases the asset price

Less asset demand decreases the asset price

Interrelation 2:

Greater asset supply decreases the asset price

Less asset supply increases the asset price

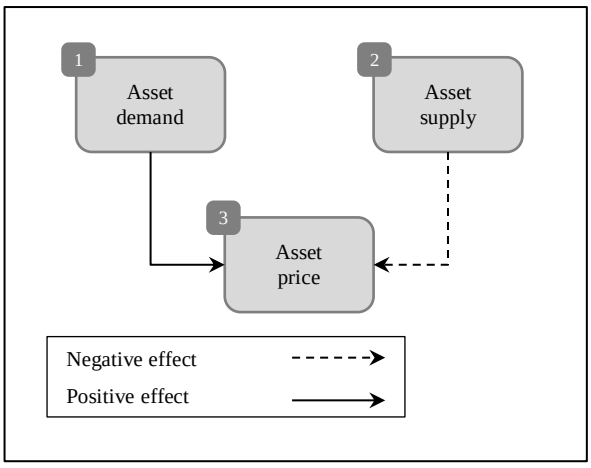


Figure 4-1: Impact graph of price theory

4.1.2 Asset price theory

The individual attractiveness of an asset is derived from its expected risk-return ratio compared to the market risk-ratio. The expected return of an asset is calculated by the present value of future incoming cash flows. The risk quantifies the threat of a loss in value. There are two influencing factors. First, lower expected returns are accepted for defensive assets. More sensitive assets require a risk premium on the expected return. The starting point is a risk-free rate influenced by the general interest rate. Second, the asset's individual expected return per risk unit is compared with other assets in the market. A

better individual risk-return-ratio causes higher demand and less supply (Lintner, 1965; Sharpe, 1964). In the end, the asset price model places the assets according to their attractiveness.

Interrelation 3:
A higher expected risk of assets decreases the asset risk-return ratio
A lower expected risk of assets increases the asset risk-return ratio

Interrelation 4:
A higher expected return of assets increases the asset risk-return ratio
A lower expected return of assets decreases the asset risk-return ratio

Interrelation 5:
A higher general rate of interest increases the market risk-return ratio
A lower general rate of interest decreases the market risk-return ratio

Interrelation 6:
A higher asset risk-return ratio increases the attractiveness of the asset
A lower asset risk-return ratio decreases the attractiveness of the asset

Interrelation 7:
A higher market risk-return ratio decreases the attractiveness of the asset
A lower market risk-return ratio increases the attractiveness of the asset

Interrelation 8:
A higher attractiveness of the assets increases the asset demand
A lower attractiveness of the assets decreases the asset demand

Interrelation 9:
A higher attractiveness of the assets decreases the asset supply
A lower attractiveness of the assets increases the asset supply

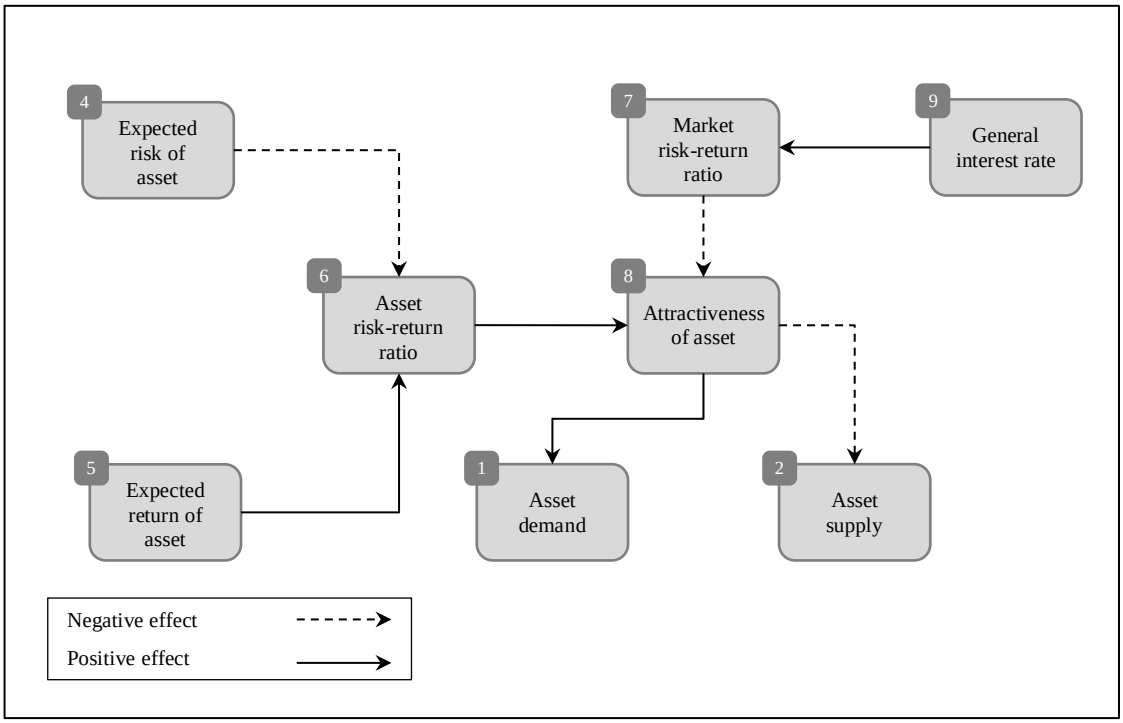


Figure 4-2: Impact graph of the asset price theory

Financial markets are seen as almost perfect economic markets due to a large number of rational market participants (Fama, 1965). The aspect of information is crucial. The efficient market hypothesis assumes that information is always available and reflected in prices.[16] Therefore, expected future changes in attractiveness are considered to have been already factored into the current price and price changes are caused by new information (Brealey et al., 2007; Fama, 1970; Samuelson, 1965). Consequently, price developments should be independent and, therefore, the serial correlation coefficients for price should be close to zero, which was confirmed by several studies (Fama, 1965). Therefore, price predictions are not possible.

The last two sections portrayed the typical behaviour in the first phase of a financial crisis. The prices of assets were particularly in focus. The next pages outline the leverage effect during financial crises.

[16] It differentiates between strong forms where investors have access to any information relevant for price formation, semi-strong forms where investors have access to all obviously publicly available information and weak forms where investors have only access to historical price or return sequences.

4.2 Expansion of credit

This section describes the second stage of financial crises. In a bull market, the expected return rates of assets become greater than the costs of debts. Therefore, additional money will be invested by financers. This leverage effect allows large investments without a significant share of own money. The additional demand for assets further increases asset prices (Kindleberger and Aliber, 2005; Minsky, 2008). Even in the 19th century Mill recognised that extended monetary borrowing played an essential role in the creation of bubbles (Roubini and Mihm, 2011). The increased debt value is inherently associated with financial crises (Jorda et al., 2011; Reinhart and Rogoff, 2008; Reinhart and Rogoff, 2009; Roubini and Setser, 2004) and the last financial crisis showed similar causes (Foster and Magdoff, 2009). Schularick and Taylor (2009) suggest that credit growth predicts financial crises.

The expansion of credit is described in the sections “Credit leverage”, “Creditworthiness”, “Credit cash flow” and “Principal payments”.

4.2.1 Credit leverage

Financed investments are attractive as long as costs for new loans are lower than the expected return from assets. The additional asset demand increases the asset price (Minsky, 2008; Vines, 2003).

Interrelation 10:
Higher costs of new loans decrease the attractiveness of financed investments
Lower costs of new loans increase the attractiveness of financed investments

Interrelation 11:
A *higher expected return of assets increases the attractiveness of financed investments*
A *lower expected return of assets decreases the attractiveness of financed investments*

Interrelation 12:
A higher attractiveness of financed investments increases new loans for investments
A lower attractiveness of financed investments decreases the new loans for investments

Interrelation 13:

More new loans for investment increase the asset demand

Less new loans for investment decrease the asset demand

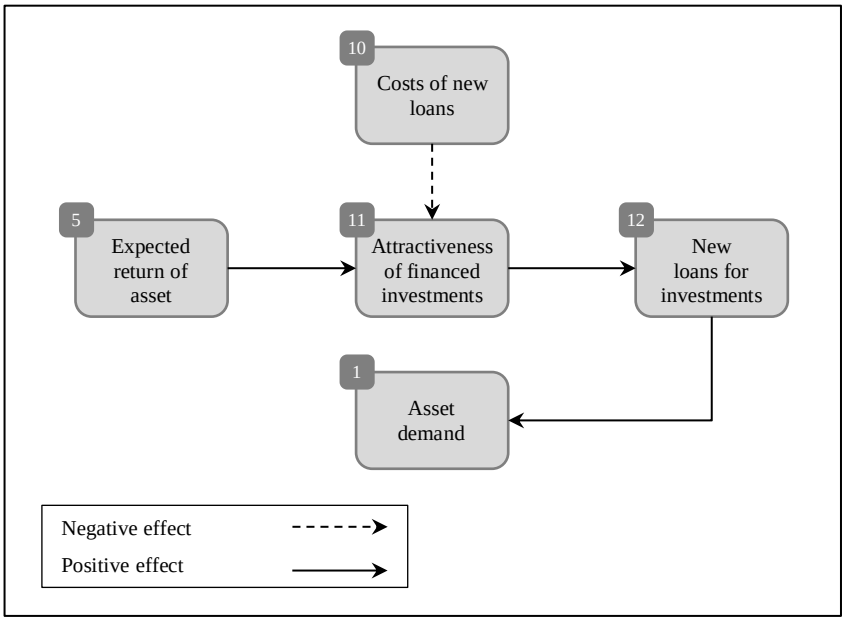


Figure 4-3: Impact graph of credit leverage

4.2.2 Creditworthiness

The costs of new loans depend on the investor's creditworthiness and the general interest rate (Spremann and Gantenbein, 2002). Investors who borrow money to invest have to provide collateral to their creditors to reduce the risk of defaulting on the debt. A higher debt value requires more collateral (Jahrmann, 2003). An increase in asset prices directly enhances the investor's creditworthiness. The balance sheet value rises. The same nominal value of debt has to be repaid by an increased value of assets and, therefore, the distribution of costs of debts and the return from assets changes. Credit standards for new loans become lighter (Minsky, 2008). In addition, an increase in asset prices increases the actual collateral value of the asset, thus lightening the credit standards for new loans as well (Kiyotaki and Moore, 1997). Empirical studies confirm that banks tend to grant more loans in good times (Maddaloni and Peydró, 2010).

In addition, past payment practices influence the creditworthiness (Jahrmann, 2003). A debt default, therefore, negatively affects the assumed creditworthiness. Reinhart and Rogoff (2009) discuss reasons for the willingness of debtors to meet their debt obligations.

In the past, a debtor faced armed interventions by the creditor. Today, debtors strive for a good reputation that is liable to be negatively affected by defaults and defaulted debtors tend to risk losing their right to borrow in future.

Interrelation 14:
A higher creditworthiness of financed investors decreases the costs of new loans
A lower creditworthiness of financed investors increases the costs of new loans

Interrelation 15:
A higher general rate of interest increases costs of new loans
A lower general rate of interest decreases costs of new loans

Interrelation 16:
More loans for investments decrease the creditworthiness of financed investors
Less loans for investments increase the creditworthiness of financed investors

Interrelation 17:
A higher asset price increases the creditworthiness of financed investors
A lower asset price decreases the creditworthiness of financed investors

Interrelation 18:
A higher risk of debt default decreases the creditworthiness of financed investors
A lower risk of debt default increases the creditworthiness of financed investors

Interrelation 19:
Higher costs of new loans increase the later payments of the debitor for new loans
Lower costs of new loans decrease the later payments of the debitor for new loans

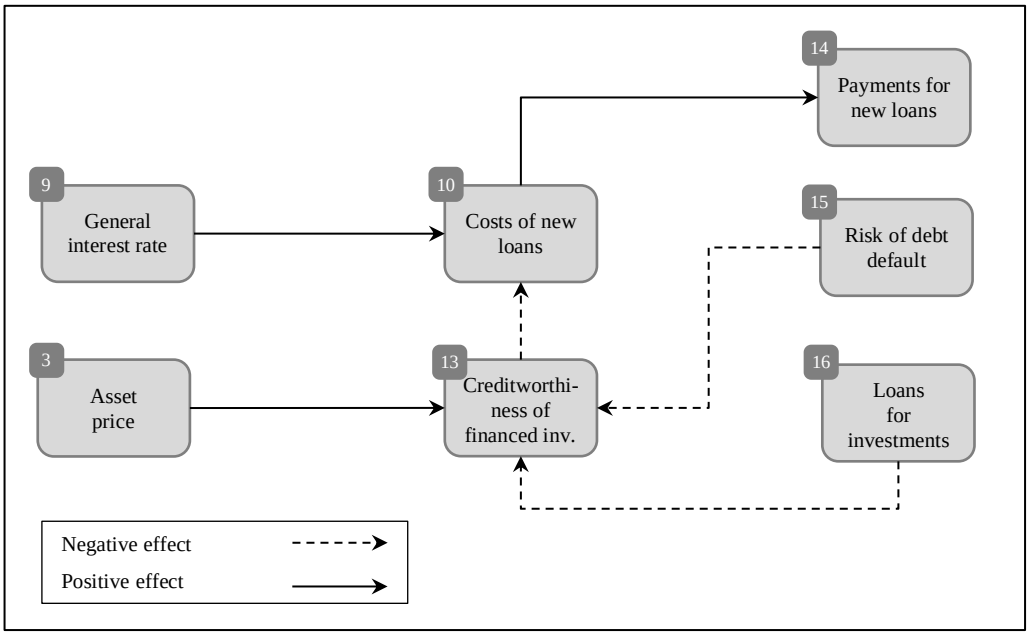


Figure 4-4: Impact graph of creditworthiness of financed investors

4.2.3 Credit cash flow

Financed investors are obliged to provide interest and principal payments to their creditors. To ensure permanent liquidity the expected returns from the asset needs to be higher than the outgoing payments. Otherwise, the debt would be seen as defaulted (Spremann and Gantenbein, 2002).

Interrelation 20:
A higher expected return of assets increases the expected asset cash flow
A lower expected return of assets decreases the expected asset cash flow

Interrelation 21:
More payments for loans decrease the asset cash flow
Less payments for loans increase the asset cash flow

Interrelation 22:
A higher asset cash flow decreases the risk of debt default
A lower asset cash flow increases the risk of debt default

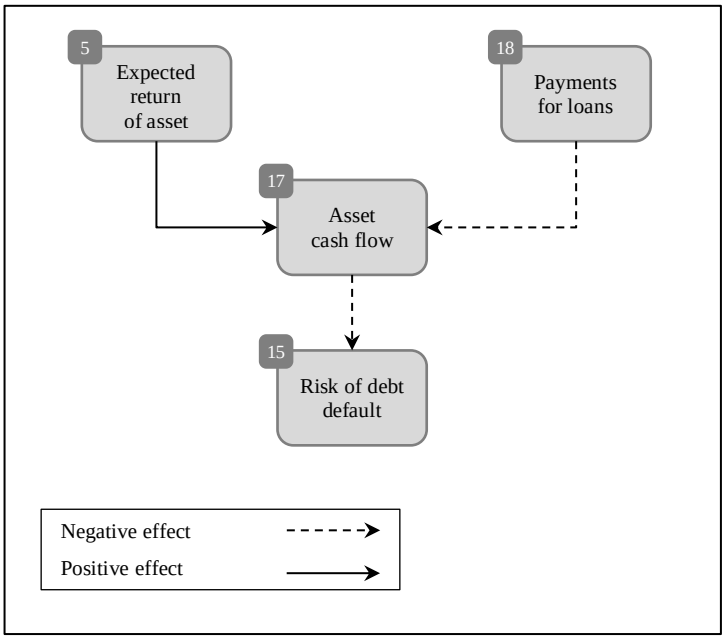


Figure 4-5: Impact graph of credit cash flow

4.2.4 Principal payments

New loans increase the overall indebtedness of financed investors, adding new interest and principal payments burdens to overall payments. Principal payments decrease the overall value of loans over the time. Interest and principal payments of financed investors increase the liquidity of banks (Jahrmann, 2003).

Interrelation 23:
More new loans for investments increase the loans for investments (overall)
Less new loans for investments decrease the loans for investments (overall)

Interrelation 24:
More new loans for investments increase the payments made under new loans
Less new loans for investments decrease the payments made under new loans

Interrelation 25:
More payments for new loans increase the payments for loans (overall)
Less payments for new loans decrease the payments for loans (overall)

Interrelation 26:

More payments for loans decrease the loans for investments (overall)

Less payments for loans increase the loans for investments (overall)

Interrelation 27:

More payments for loans increase the liquidity of banks

Less payments for loans decrease the liquidity of banks

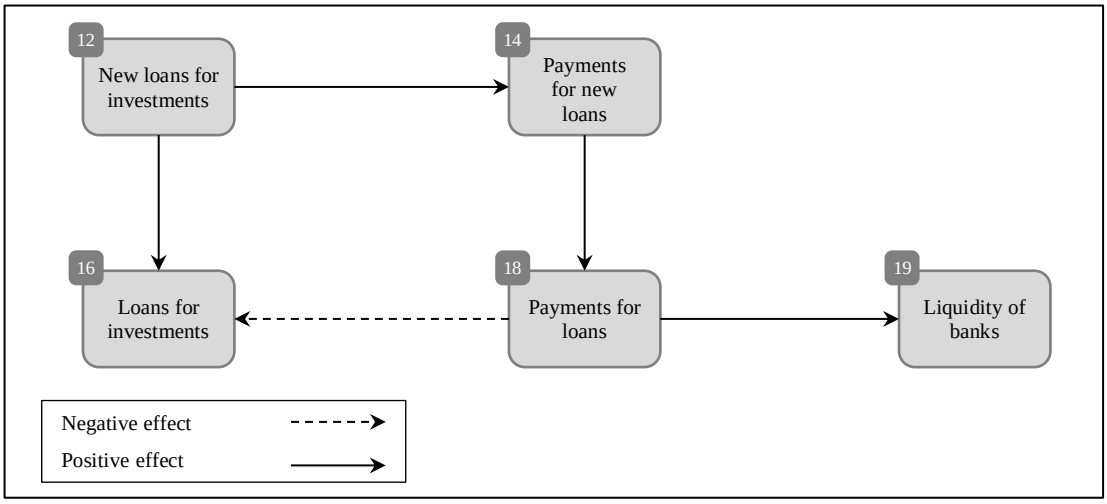


Figure 4-6: Impact graph of principal payments

The last four sections explained the effects of the expansion of credit during financial crises, characterising their second phase. The next pages deal with the next stage of financial crises.

4.3 Euphoria

This part of the thesis also describes the third stage of financial crises. The rush of prices leads to the expectation of higher prices, causing euphoria which, in the end, leads to higher prices. Because of this positive feedback mechanism, speculation fuels itself (Galbraith, 1993; Roubini and Mihm, 2011). In addition, the bull market is amplified by herd behaviour and moral hazard effects (Kindleberger and Aliber, 2005). Warnings of bubbles and the resulting crashes are seen as a lack of faith in the wisdom of markets (Galbraith, 1993). Even Bagehot perceived that every great crisis was previously linked to excessive speculation that had raised prices (Bagehot, 1873). Additionally, financed

investors tend to repay debts by new debts, which, in special circumstances, is regarded as a fraudulent approach (Kindleberger and Aliber, 2005).

Euphoria is described in the sections "Non-rational markets", "Speculation", "Price correction mechanisms", "Herd behaviour", "Moral hazard" and "Fraud".

4.3.1 Non-rational markets

The rational market mechanism of asset prices cannot explain all developments of asset prices. Grossman and Stiglitz (1980) proved that the efficient market hypothesis, including the reflection of all information can hardly be true. Only one badly informed market participant can cause non-equilibrium. In addition, single market participants are capable of influencing price developments despite a large number of market participants (Soros, 1994; Vines, 2003). Summers (1986) identified that the analysis of stock prices that are the result of non-rational behaviour, can hardly be distinguished from prices based on rational behaviour. Therefore, the results of stock prices analysis that produced the effective markets hypothesis must be viewed with scepticism. If the behaviour of market participants had always been rational, only asset performance would have played a role in investment decisions. To identify the reason of investors' acting irrationality, Shiller (1990) conducted a survey before and during a financial crisis and identified psychological aspects. His results show that more than 40% of individual investors experienced unusual symptoms of anxiety, which might have influenced their decisions. Keynes (1936) described that economic decisions are associated with "animal spirits". Instead of reasonable calculation, they could be spontaneous actions. Therefore, additional aspects may influence asset pricing.

4.3.2 Speculation

According to the efficient market hypothesis the expected return considers only discounted incoming cash flow (e.g. dividends). However, Shiller (1981) demonstrated that actual changes in stock prices were too volatile compared to changes in their expected dividends. Asset price changes are caused without new information on the asset because investors believe in changed expectations of other investors (Kraus and Smith, 1998). Keynes (1936, p. 156) characterised the investor mind-set as "anticipating what average opinion expects

the average opinion to be". Allen et al. (1993) suggest that investors do not know the ideas of other investors. An investor thinks an asset can be sold at a higher price before its true value becomes common knowledge despite everybody knowing that the asset is overpriced. This is a second way to earn money from assets next to incoming cash flows. The rush of prices fuels the expectation of higher prices and euphoria, thus letting the expected returns from the asset increase. Speculation is building itself due to positive feedback mechanisms. Higher expected returns fuel the price hike (Galbraith, 1993; Roubini and Mihm, 2011). Samuelson suggests "the most wonderful thing about a bull market is that it creates its own hopes. If people buy because they think stocks will raise, their act of buying sends up the price of stocks. This causes them to buy still further" (Fox, 2009, p. 65). If prices fall, the fantasy vanishes entirely and the trust in the expected returns is subverted (Black, 1988).

Interrelation 28:
A higher asset price increases euphoria
A lower asset price decreases euphoria

Interrelation 29:
More euphoria increases the expected return of the asset
Less euphoria decreases the expected return of the asset

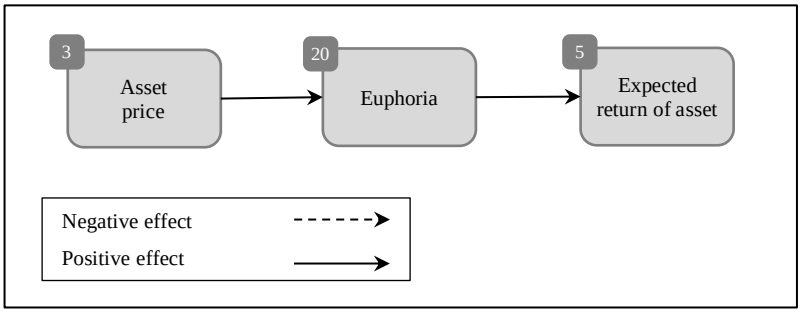


Figure 4-7: Impact graph of speculation

4.3.3 Price correction mechanisms

Market participants who believe that the expected return is exaggerated may sell borrowed assets with the intention of purchasing them later at a lower price. Owing to the market mechanism of supply and demand the price would fall. The supply of assets increases in

the short-term and, in the mid-term, the demand for the asset increases (Mishkin, 2010). General limits of arbitrage are identified. Well-informed investors can only partly undo the "damage" of over-valued prices. The arbitrage is particularly ineffective in extreme circumstances, where prices are significantly out of line and arbitrageurs are fully invested (Fama and French, 2007; Shleifer and Vishny, 1997). The market statement "markets can remain irrational longer than you can remain solvent" outlines the dilemma. Short sales increase only when euphoria vanishes.

Interrelation 30:
More short sales increase the asset supply
Less short sales decrease the asset supply

Interrelation 31:
More short sales increase the asset demand
Less short sales decrease the asset demand

Interrelation 32:
A higher asset price increases short sales
A lower asset price decreases short sales

Interrelation 33:
More euphoria decreases short sales
Less euphoria increases short sales

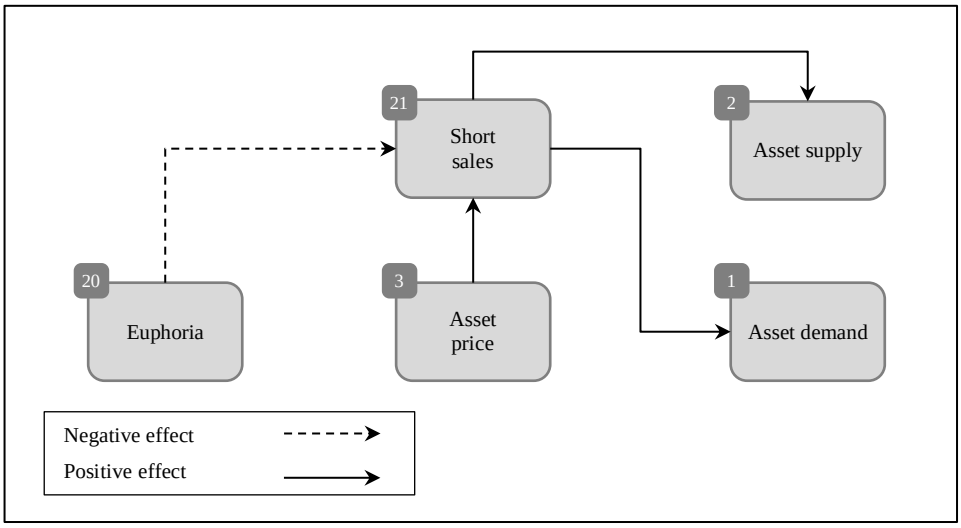


Figure 4-8: Impact graph of price correction mechanisms

4.3.4 Herd behaviour

Participants of markets move as a herd (Kindleberger and Aliber, 2005). There are several empirical studies that discovered the imitative behaviour in price developments. Cont and Bouchaud (2000) provide a broad overview. Mackay (1841) called their behaviour "the madness of crowds". Even investors strive to follow a specific trend on markets (Vines, 2003; Zhou and Anderson, 2013). One of Pixley's interviewees confirmed such behaviour also in professional investment circles in order to avoid that they "look stupid" (Pixley, 2004). In particular, portfolio managers of funds tend to behave in a similar way. They follow the rule that it is better to fail conventionally than to succeed unconventionally (Keynes, 1936). Therefore, more demand for an asset, leads to more demand and more supply causes additional supply.

Interrelation 34:
More asset demand increases the asset demand
Less asset demand decreases the asset demand

Interrelation 35:
More asset supply increases the asset supply
Less asset supply decreases the asset supply

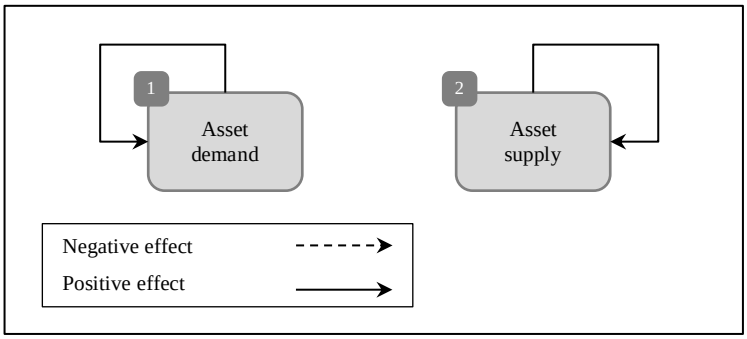


Figure 4-9: Impact graph of herd behaviour

4.3.5 Moral hazard

Vogl (2011) assumes that the weaknesses of human behaviour drive irrational market volatilities. One of the root causes of the misbehaviour leading to failures of companies is the current system of compensation that encourages short-term returns instead of long-term sustainability. The management tries to maximise their personal income, which may depend on the asset price of their employer. By the acceptance of higher risks for their company, they may increase the expected return of the company, leading to an increased asset price and, hence, to an increased personal income (Roubini and Mihm, 2011). Goodhart (2011) took the same line. He says that misleading executive remuneration is accompanied by a moral hazard. Even, a former chair of the United States Securities and Exchange Commission (SEC) criticised the earnings of management during his active career that were the result of "big bath restructuring charges, creative acquisition accounting, cookie jar reserves, improper revenue recognition and abuse of materiality" (Pixley, 2004, p. 127). Lakonishok et al. (1991) identified immoral management behaviour even in funds. Fund managers alter their asset portfolios at the end of a quarter when their performances are routinely evaluated. They assume that fund managers want to impress their sponsors. Their strategies range from the selling of low-performing assets to the avoidance of purchases of high-performing assets after a significant rise in price. The sponsors would realise that the assets were not held during the raise. The moral hazard is not only limited to the relationship of the market participants and the senior management. It also exists between different levels of management.

The risky behaviour of market participants is supported by missing consequences for mismanagement. They know that official parties will not let their companies fail. They are "too big to fail" (Roubini and Mihm, 2011). Bagehot (1873) assumed that losses by

mistakes in duty are more precarious than losses by fraud. Next to individual weaknesses, whole markets are associated with an inherent risk of systemic instability. An example of systemic instability is provided by Minsky (2008). The distribution of a bank's market share follows a risk spiral. After one market player accepts a higher risk, all other market players have to accept higher risks as well to prevent a loss of market share (Kindleberger and Aliber, 2005). The possibility that market competition decreases moral values was a hypothesis without empirical evidence until Falk and Szech (2013) conducted their experiments and identified that causality.

Interrelation 36:
A higher asset price increases the risk of misbehaviour
A lower asset price decreases the risk of misbehaviour

Interrelation 37:
A higher risk of misbehaviour increases the expected risk of the asset
A lower risk of misbehaviour decreases the expected risk of the asset

Interrelation 38:
A higher risk of misbehaviour increases the expected return of the asset
A lower risk of misbehaviour decreases the expected return of the asset

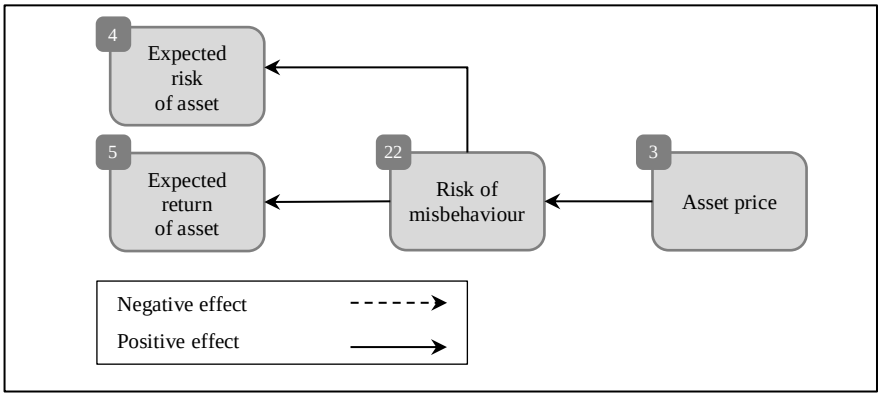


Figure 4-10: Impact graph of moral hazard

4.3.6 Fraud

Financed investors are obliged to provide interest and principal payments to their creditors. In this phase of a crisis a particular part of Minsky's theories become relevant to ensure

permanent liquidity. He made distinctions among investors. There are hedged financed investors, speculative investors and Ponzi financed investors. A hedged financed investor repays interest and principal payments from the returns earned from the asset. Speculative and Ponzi financed investors repay existing loans from new loans (Kindleberger and Aliber, 2005; Minsky, 2008).[17]

Interrelation 39:
More new loans for investment increase the asset cash flow
Less new loans for investment decrease the asset cash flow

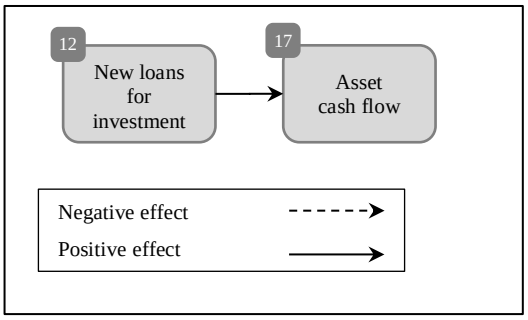


Figure 4-11: Impact graph of fraud

The last six sections described the third stage of financial crises characterising a boom in asset prices. However, the last stage stops the price movement. This is outlined in the next section.

4.4 Critical stage and revulsion

This section describes the last stage of financial crises. Significant price drops are triggered by a pause in the price rises or unexpected developments (Kindleberger and Aliber, 2005; Roubini and Setser, 2004). The difference between reality and fantasy appears to widen (Soros, 1994). The actual information drives lower expectations for the expected returns from assets (Black, 1988). The costs of new debts could raise above the returns of the assets. This makes further financed investments unattractive and, hence, financed investors do not get additional loans. The option to sell assets is attractive to fulfil contractual obligations, that, finally, leads to a contagion (Kindleberger and Aliber, 2005; Minsky,

[17] The speculative financed investor repays the principal payments from the return and the interest payments from new loans. The Ponzi financed investor repays both the principal and the interest obligations with new loans.

2008) often associated with bank runs (Calomiris and Gorton, 1991; Diamond and Dybvig, 1983).

The critical stage and revulsion are described in the sections “Exuberated prices”, “Over-indebtedness”, “Contagion” and “Bank runs”.

4.4.1 Exuberated prices

This section describes various reasons for exuberated expectations. They are wide-ranged but, in the end, it is always a question of accurate information.

Ratings

The last financial crisis showed poor risk assessments by rating agencies, which were caused by conflicts of interest, disclosures, internal policies and business practices (Mullard, 2012). Schwarcz (2009) points out that incomplete information and a lack of risk understanding may be the cardinal causes for the last financial crisis. Owing to securitisation of mortgage loans, the lender of money and the owner of the loan were separated. The securitisation process was spread over several firms. It was hardly possible for each market participant to calculate the individual risk of an asset or a collection of assets.

Accounting standards

Globally, different accounting standards are applied. It can be differentiated between market-to-market accounting focusing on the future earnings in asset pricing and conventional accounting focusing on earnings of the past in the asset pricing (Allen and Carletti, 2008). Pixley (2004) discusses that market-to-market approaches tend to exaggerate expected returns and future price developments. However, asset prices decrease during financial crises. In this case, more conventional accounting standards have an advantage. Asset prices do not drop as significantly as it is the case in market-to-market approaches (Allen and Carletti, 2008). In addition, accounting standards may affect transparency. In particular, off-balance sheet transactions were identified as a reason of the last financial crisis (Financial Stability Forum, 2008; Ingves and Lind, 2008).

Media

Further, the role of the media and their influence on price developments has been discussed. In general, studies do not show causalities between news about assets and their price movement. However, price records of assets are emphasised in the media (Shiller, 2001) and Pixley (2004) suggests that uncritical journalism may influence prices.

Regulatory supervision

Regulators define requirements for financial institutions regulating asset holdings, capital requirements, risk management, government safety nets, disclose requirements, consumer protection and restrictions on competition (Mishkin, 2010). Some economists claim that regulatory forbearance is partly responsible for the crisis. Regulators accepted the overvaluing of bank assets prior to the last crisis (Huizinga and Laeven, 2012). Espinosa-Vega et al. (2011) argues that regulatory forbearance might arise because of global competition among regulatory agencies. Regulators may have little incentive to gather and share information with other regulators.

Irrational behaviour

Finally, not all market participants understand the market mechanisms and, therefore, cannot be well informed (Soros, 1994; Vogl, 2011). Kahneman and Tversky show that people have problems with the understanding of probability. For the calculation of the risk-return ratio, people tend to underplay returns associated with high risks compared to returns associated with low risks (Kahneman and Tversky, 1979; Tversky and Kahnman, 1974).

4.4.2 Over-indebtedness

Bernanke et al. (1996) developed the financial accelerator theory. Their model describes increased debt costs in case of a downturn causing real economic recessional shocks.

The decrease of asset prices directly reduces the creditworthiness of investors. The balance sheet value declines. The same nominal value of debt has to be repaid by a decreased value of assets and, therefore, the distribution of costs for debts and the return from assets

changes (Minsky, 2008). Credit standards for new loans become tighter (Kindleberger and Aliber, 2005; Kiyotaki and Moore, 1997).[18]

In the special case of professional derivatives trading, a decrease in asset prices reduces the actual collateral value of the asset. If the actual value drops below the required collateral value, the financed party has to either provide liquidity or other collateral to the creditor as compensation. The degree of freedom of the company's financial management would be limited by the outflow of money and the additional collateralisation of other assets (Herring and Schmidt, 2011).

4.4.3 Contagion

Tightened credit standards for new loans may surprise financed investors when debts mature. The costs of new debts could raise above the returns from the assets. The debt cannot be prolonged and the option to sell assets appears attractive to fulfil contractual obligations (Minsky, 2008). Financed investors fly to liquidity to ensure the debt repayment, leading to what is called the "Minsky moment". Consequently, an increased supply of the asset causes a further price drop (Kindleberger and Aliber, 2005). At this stage even losses are accepted to stay liquid (Reinhart and Rogoff, 2008). The flight to liquidity is not limited to one asset. Other assets are also on the supply line causing a drop in their prices as well (Kindleberger and Aliber, 2005; Minsky, 2008). The downward spiral is not limited to debtor and creditor relations. The liquidity run affects trade linkages and insurances. Further, it becomes a wake-up signal for risk assessments of other assets (Kaminsky and Reinhart, 2000; Kruger et al., 1998; Roubini and Setser, 2004). It is this combination of contagion channels that spread financial crises (Collins and Gavron, 2004). In fact, the entire market runs the risk of being infected. The expansion of liquidity problems of interrelated parties is a distinctive field of science, the systemic risk analysis on financial markets. Bandt and Hartmann (2000) present an overview of academic discussions. The model of Brunnermeier and Pedersen (2009) show how difficult it is to gain liquidity and explain why markets can suddenly dry up. However, any new demand for assets may provide liquidity and reduce the risk of contagion (Roubini and Mihm, 2011).

[18] The described mechanism is identical to the already described elements and interrelations of Chapters 4.1, 4.2 and 4.3. The difference is the asset price. Instead of a further increase of asset prices, they start to decline and trigger the opposite effects.

Interrelation 40:

A higher risk of debt default increases the risk of contagion

A lower risk of debt default decreases the risk of contagion

Interrelation 41:

A higher risk of contagion increases the asset supply

A lower risk of contagion decreases the asset supply

Interrelation 42:

A higher risk of contagion decreases the market risk-return ratio

A lower risk of contagion increases the market risk-return ratio

Interrelation 43:

A higher asset demand decreases the risk of contagion

A lower asset demand increases the risk of contagion

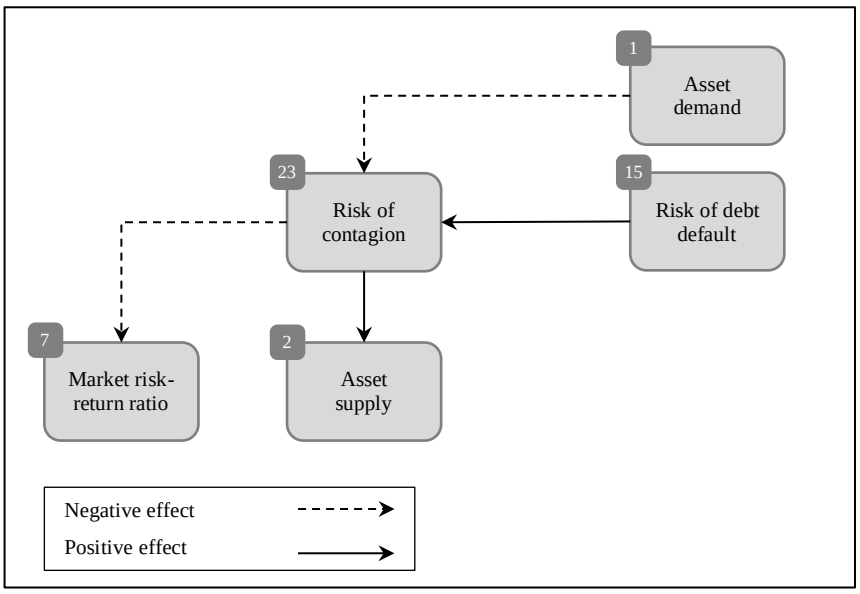


Figure 4-12: Impact graph of contagion

4.4.4 Bank runs

Illiquidity is the cardinal risk of companies caused by different term structures of outgoing and incoming cash flows (Roubini and Setser, 2004). Banks, in particular, are vulnerable when a more than expected number of depositors withdraw their money, which occurs due

to a flight to liquidity. Various models try to explain bank runs. Freixas et al. (1999) provides a profound overview. Diamond and Dybvig (1983) explain bank runs by the herd behaviour of depositors. An individual depositor does not know what other depositors expect. When an individual depositor expects others to leave their money in the bank he leaves the money as well. However, the individual depositor tries to withdraw the deposited sum when he expects other depositors want to withdraw theirs. In addition, the lack of information regarding the bank's risks (e.g. underperforming assets) may be a cause of bank runs. If depositors believe in underperforming banks in the market, they begin to withdraw money in such cases as well. In the end, a system-wide panic may occur (Calomiris and Gorton, 1991). Banking crises often occur following price booms in real estate assets (Reinhart and Rogoff, 2009). There is one cardinal risk in banking management. The financing of long-term assets by short-term debts may lead to bankruptcy in case of a shortage of new market liquidity (Roubini and Mihm, 2011). An additional risk is posed by foreign debtors, which pull their money out of banks when the foreign exchange rate are expected to drop. Further, capital structure mismatches resulting from an unbalanced liabilities and equity ratio have an impact in bad times. Loans define a contractually fixed rate of interest that must be paid. In contrast, the equity rate of return is floating and increases the degree of financial freedom (Roubini and Setser, 2004).

Taylor (2009) suggests that uncertainty about the counterparty risk of other banks reduces interbank lending. During a crisis, banks are unable to assess the solvency of other banks, which increases the reluctance of interbank lending (Freixas et al., 1999). This effect is intensified by the fact that the lending between banks is unsecured. Only the creditworthiness of banks influences the conditions of lending contracts. In addition, banks tend to do a bit balance sheet dressing. Banks with liquidity want to look respectable in the end-of-year financial report and avoid lending (Taylor, 2009).

In the end, banks and creditors are unwilling to grant new loans during financial crises (Freixas et al., 1999; Kindleberger and Aliber, 2005). A halt in banks' liquidity outflow causes liquidity shortages among clients.

Interrelation 44:

A higher risk of contagion decreases the liquidity of banks

A lower risk of contagion increases the liquidity of banks

Interrelation 45:

A higher liquidity of banks increases the creditworthiness of banks

A lower liquidity of banks decreases the creditworthiness of banks

Interrelation 46:

A higher creditworthiness of banks decreases the risk of contagion

A lower creditworthiness of banks increases the risk of contagion

Interrelation 47:

A higher foreign exchange rate increases the liquidity of banks

A lower foreign exchange rate decreases the liquidity of banks

Interrelation 48:

More interbank lending increases the liquidity of banks

Less interbank lending decreases the liquidity of banks

Interrelation 49:

More uncertainty decreases interbank lending

Less uncertainty increases interbank lending

Interrelation 50:

A higher risk of debt default increases uncertainty

A lower risk of debt default decreases uncertainty

Interrelation 51:

A higher risk of debt default decreases the creditworthiness of banks

A lower risk of debt default increases the creditworthiness of banks

Interrelation 52:

More liquidity of banks increases new loans for investments

Less liquidity of banks decreases new loans for investments

Interrelation 53:

More new loans for investments decrease the liquidity of banks

Less new loans for investments increases the liquidity of banks

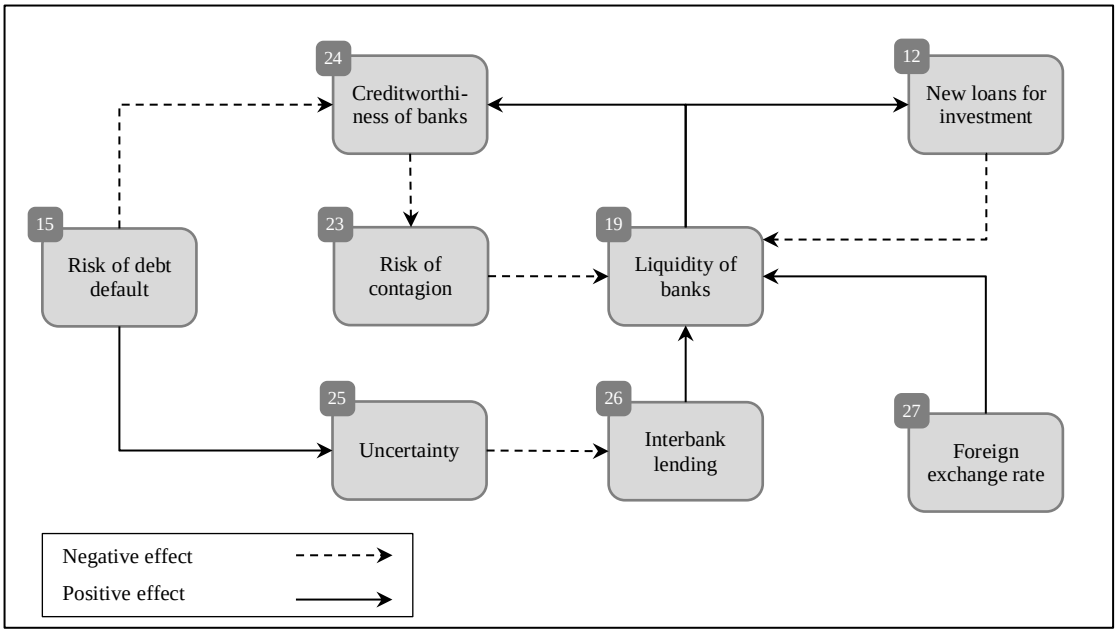


Figure 4-13: Impact graph of bank runs

The last four sections illustrated the mechanisms during a financial market burst. The next section deals with the curb on the spread of a financial crisis.

4.5 Containment of financial crises

This part of the thesis describes the containment actions during financial crises that were introduced in Chapter 2.3. The results of the analyses are documented in Chapter 5 and the application of actions in times of historical financial crises is shown in Chapter 6. Theories about financial containment actions affect the financial crisis model summarised in Chapter 4.6.

The catalogue of actions is distributed over a range of institutions. The sections "Containment actions of central banks", "Lender of last resort" and "Containment actions

of governments and regulators" explain potential actions that are the subject of systemic analyses.

Table 4-1 provides an overview of actions, linked elements and their effects from a systemic point of view. The subsequent sections present the details.

Table 4-1: Overview of financial crisis containment actions

#	Action	Effect of action			Authors
		Element	Increase	Decrease	
1-1	Extension of money supply	28: Money supply	Yes	No	Ahrend et al. (2008), Andersson (2011), Belongia and Ireland (2014), Collins and Gavron (2004), European Central Bank (2011), Fama and Schwert (1977), Fama (1981), Friedman and Schwartz (2007) Hagen von (2009), Mishkin (2009), Mishkin (2010), Pearce and Roley (1985), Schwert (1981)
1-2	Increasing of general interest rate	9: General rate of interest	Yes	No	Artuc and Demiralp (2010), Blinder (1972), Cecchetti (2008), European Central Bank (2011), Ghosh et al. (2009), Lahiri and Vegh (2003), Mishkin (2009), Mishkin (2010), Roubini and Setser (2004)
1-3	Decreasing of general interest rate	9: General rate of interest	No	Yes	
1-4	Appreciation of domestic currency	27: Foreign exchange rate	Yes	No	Burnside et al. (2008), Calvo (1998), Calvo and Reinhart (2000), Ghosh et al. (2009), Mishkin (2010), Roubini and Mihm (2011), Roubini and Setser (2004), Sarno and Taylor (2001)
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No	Yes	
1-6	Asset purchases from markets	1: Asset demand	Yes	No	Ahamed (2009), Bernanke et al. (2004), Chernow (2010), Galbraith (1973), Garcia and Nieto (2013), Laeven and Valencia (2011), Roubini and Mihm (2011)
1-7	Asset purchases from banks	19: Liquidity of banks	Yes	No	
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	Yes	No	Cheun et al. (2009), European Central Bank (2008), Garcia and Nieto (2013)
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	No	Borio et al. (2010), Cottarelli and Vinals (2009), Cumming (2013), Faure and Heine (2013), Galbraith 1973), Garcia and Nieto (2013), Ghosh et al. (2009), Goldberg et al. (2011), Goodhart and Huang (2005), Hüpkes (2013), Laeven and Valencia (2011), Panetta et al. (2009), Singh (2011), Stone et al. (2011)
2-2	Provision of liquidity to financed investors	17: Asset cash flow	Yes	No	
2-3	Provision of foreign liquidity to banks	19: Liquidity of banks	Yes	No	

#	Action	Effect of action			Authors
		Element	Increase	Decrease	
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes	No	Borio et al. (2010), Cottarelli and Vinals (2009), Cumming (2013), Dell' Ariccia et al. (2008), Demirgüç-Kunt et al. (2015), Garcia and Nieto (2013), Goodhart (2008), Grande et al. (2013), Krueger (2002), Laeven and Valencia (2011), Panetta et al. (2009), Singh and LaBrosse (2011), Singh (2011)
3-2	Asset purchases programme	19: Liquidity of banks	Yes	No	Borio et al. (2010), Cottarelli and Vinals (2009), Honohan (2012), Panetta et al. (2009)
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes	No	Deutsche Bundesbank (2009), Klingebiel (2000), Singh (2011)
3-4	Debt moratoria for financed investors	18: Payments for loans	No	Yes	Calomiris et al. (2012), Friedman and Schwartz (2007)
3-5	Accounting discretion	24: Creditworthiness of banks	Yes	No	Calomiris et al. (2012), Huizinga and Laeven (2012)
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	Yes	No	Laeven and Valencia (2010)
3-7	Bank holidays on exchanges	3: Asset price	Yes	No	Colesanti (2010), Galbraith (1973)
3-8	Stress tests	25: Uncertainty	No	Yes	Bank of England (2013), Claessens et al. (2011), Knight (1921), Pritsker (2012) Taylor (2009)
3-9	Prohibition of short sales	21: Short sales	No	Yes	Frino et al. (2011), McMillan and Philip (2012)

4.5.1 Containment actions of central banks

This section shows possible containment actions of central banks. The next pages describe the actions “Extension of money supply”, “Increasing or decreasing of general interest rate” and “Appreciation or depreciation of domestic currency”. In addition, the actions “Asset purchases from markets or from banks” and “Lightening of collateral requirements” are outlined.

4.5.1.1 Extension of money supply

Mishkin (2009) argues that a tightened monetary policy initiates an economic downturn during financial crises. A shortened money supply causes higher costs of new loans, contracting, in the end, economic activities and negatively impacting asset prices.

The money supply comprises different kinds of money. Central banks differentiate between narrow, intermediate and a broad monetary aggregate that reflect the degree of liquidity. A narrow monetary aggregate comprises high liquid money and broad money aggregates are defined as assets with a maturity of up to two years (European Central Bank, 2011).

Different tools may be applied to adjust the money supply. Open market operations are agreements between the central bank and banks either to lend money or to purchase and repurchase securities. Central bank loans or purchases of assets add to reserves in the market and the repayment or the sale of assets drain market liquidity (European Central Bank, 2011). Belongia and Ireland (2014) suggest that the adjustment of money supply is a significant factor in the adjustment of the interest rates.

Central banks create the so-called base money. This amount is multiplied by banks through deposit creation. The liabilities of one bank can be borrowed to a second bank. The second bank receives the initial value, reduced by the reserves required. This liability of the second bank can be borrowed to a third bank. In the end, the initial value of the liability gets multiplied (Mishkin, 2010). However, during a financial crisis, the money multiplier decreases due to an increased liquidity preference of banks, leading to less interbank lending. This causes a fall in the money supply (Hagen von, 2009).

In general, more market liquidity reduces the risk of contagion (Friedman and Schwartz, 2007). However, higher money supply may cause higher inflation (Mishkin, 2010), which may increase the risk of contagion (Collins and Gavron, 2004).[19] In addition, foreign investors subtract the increased expected inflation from the foreign exchange rate changes (Mishkin, 2010). The relation of monetary policy, higher inflation and the price of assets are still being discussed. Some scientists have found a negative relation between inflation and stock prices (Fama and Schwert, 1977; Fama, 1981; Schwert, 1981) that could not be confirmed by other studies (Pearce and Roley, 1985). Scientists found a positive relation between an accommodative monetary policy and real estate prices (Ahrend et al., 2008). The latest studies show a positive correlation between money supply and asset prices. More money growth leads to an increase in asset prices (Andersson, 2011).

Interrelation 54:
More money supply increases the liquidity of banks
Less money supply decreases the liquidity of banks

Interrelation 55:
More interbank lending increases the money supply
Less interbank lending decreases the money supply

Interrelation 56:
More money supply increases the risk of contagion
Less money supply decreases the risk of contagion

Interrelation 57:
More money supply decreases the foreign exchange rate
Less money supply increases the foreign exchange rate

Interrelation 58:
More money supply increases the asset price
Less money supply decreases the asset price

[19] It is assumed that the effects on inflation are more significant. However due to the opposing effect of more market liquidity, a weak intensity is assumed.

Interrelation 59:

More money supply increases the market risk-return ratio

Less money supply decreases the market risk-return ratio

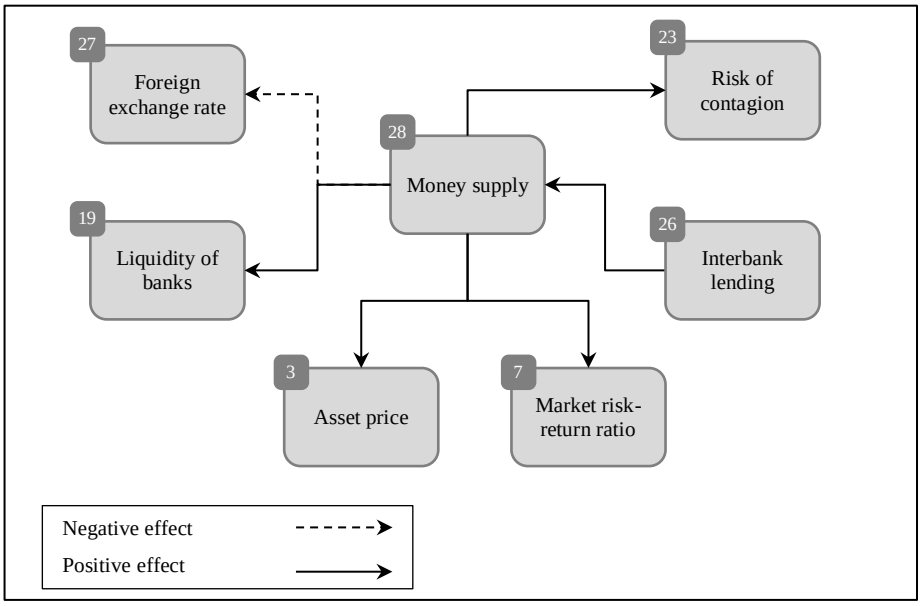


Figure 4-14: Impact graph of money supply

4.5.1.2 Increasing or decreasing of general interest rate

The general interest rate defines the costs banks have to pay for liquidity from the central bank. The open market operations of the central bank affect the interest rate in the market. Direct overnight borrowing by banks sets the ceiling for the overnight interest rate (Cecchetti, 2008). According to Blinder (1972) it can be seen as the central bank's main policy instrument. In the past, discount window borrowings from a central bank were a mark of weakness of banks. However, the concept was adjusted, eliminating the reluctance of banks to borrow from central banks (Artuc and Demiralp, 2010).

Interest rates can either be directly defined or they are indirectly adjusted by the reserve requirements (European Central Bank, 2011). Tighter reserve requirements cause higher interest rates for overnight loans (Mishkin, 2010).

The foreign exchange is influenced according to the theory of interest rate parity. A higher general rate of interest leads to more foreign capital inflows and pushes up the foreign exchange rate so that interest rates are equalised internationally (Mishkin, 2010). However,

market players with demand for money facing higher costs because of increased interest rates, which could drive them into insolvency (Roubini and Setser, 2004).

Lahiri and Vegh (2003) analysed the consequences of interest rate adjustments during financial crises. They showed that the raising of short-term interest rates attracts new foreign investors and market liquidity increases. However, beyond a certain point a crisis can be accelerated because of the higher costs of new loans. Decreased interest rates reduce the attractiveness of the currency to new foreign investors but market players with demand for money are faced with lower standards for new loans (Mishkin, 2009). Ghosh et al. (2009) focus only on new foreign investors. Therefore, they suggest raising interest rates.

Interrelation 60:
More money supply decreases the general rate of interest
Less money supply increases the general rate of interest

Interrelation 61:
A higher general rate of interest increases the foreign exchange rate
A lower general rate of interest decreases the foreign exchange rate

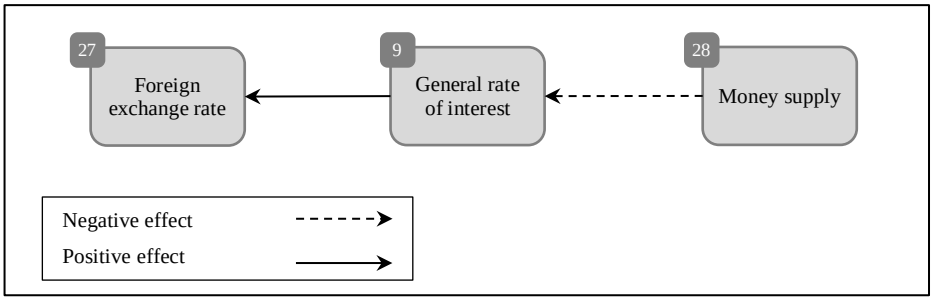


Figure 4-15: Impact graph of general interest rate

4.5.1.3 Appreciation or depreciation of domestic currency

In a perfect world, money moves to the asset with the best risk-return ratio independent of country borders. The market risk-return ratio contains foreign investments as well. Investors consider the changes in the foreign exchange rate in the risk-return ratio of assets (Mishkin, 2010). However, more foreign investments do not influence money supply. The amount of domestic currency remains unchanged. The domestic currency is only

transferred to a foreigner. Nevertheless, sudden stops in capital inflows could be dangerous. A subsequent drop of the foreign exchange rate and its domestic implications on prices and wages could initiate a depression. The domestic financial system could be damaged and domestic banking crises triggered (Calvo, 1998; Calvo and Reinhart, 2000).

Central banks held international currency reserves that enables them to influence foreign exchange rates. The sale of foreign assets is accompanied by the purchase of domestic currency that appreciates the domestic currency. The purchase of foreign assets is accompanied by a sale of domestic currency, which depreciates the domestic currency. However, the money supply is affected in both scenarios. The sale of foreign assets declines the money supply and the sale of domestic currency increases the money supply (Mishkin, 2010). If central banks simultaneously adjust their money policy, the foreign exchange rate would not be affected. The adjusted money supply would be reflected in the foreign exchange rate. However, these sterilised foreign exchange interventions may have a net effect on foreign exchange rates. In the real world, the existence of perfect market conditions cannot be taken for granted. If domestic and foreign assets are not perfectly substitutable, other market players are not able to equalise the assumed exchange rate. In addition, the actions of a central bank could be understood as signal, which may affect the expected upcoming monetary policy (Sarno and Taylor, 2001).

Foreign exchange rate depreciation can be seen as an option to restore capital flows according to Ghosh et al. (2009). In addition, capital outflow might be controlled.

In addition, there is the option to peg foreign exchange rates. Central banks adapt actions that other central banks take. An additional possibility is to peg the domestic currency to another currency either by fixed exchange rates or in bands. Pegged exchange rates leverage the debt value of a country. Foreign investments in a country lead to an increase in domestic market liquidity and to a higher demand in assets, leading to increased prices of domestic assets. Normally, the exchange rate would be internationally equalised. However, this mechanism is blocked. As long as foreign investors expect a higher risk-return ratio of domestic assets domestic asset prices increase (Mishkin, 2010). Domestic investors feel wealthier (Roubini and Mihm, 2011). However, a pegged exchange rate requires a fixed money supply. Any increase in money supply, dilutes the expected returns

because of a rising inflation, reducing the attractiveness of the assets to foreigners. Consequently, the country's ability to raise new money gets limited and could lead to a collapse, which can only be prevented by devaluation (Burnside et al., 2008). The peg of currencies is linked to the prohibition of purchases of foreign assets (Roubini and Setser, 2004). The most extreme peg of a currency is dollarization that means substitution of domestic currency by a foreign currency. In addition, the domestic country loses the seigniorage (Calvo and Reinhart, 2000).

4.5.1.4 Asset purchases from markets or banks

Bernanke et al. (2004) discuss monetary policy options and they see quantitative easing as an effective action. Instead of purchasing and repurchasing through open market operations, they suggest permanent asset purchases as an alternative tool to provide liquidity to banks and to stabilise asset prices (Laeven and Valencia, 2011). During the last financial crisis, central banks adopted this action. They intervened not only in the money market but also in the long-term investment market (Garcia and Nieto, 2013; Roubini and Mihm, 2011). This is not an altogether new action. Shortly after The Great Crash in 1929, American banks tried to stabilise markets by significant purchases from markets (Ahamed, 2009; Chernow, 2010; Galbraith, 1973). In addition, purchases can be directly made from banks.

4.5.1.5 Lightening of collateral requirements

The European Central Bank lightened the credit standard for banks at the beginning of the last financial crisis (Cheun et al., 2009; European Central Bank, 2008). More collateral were accepted for the credit process of the central bank (Garcia and Nieto, 2013), thus increasing the creditworthiness of banks.

The last pages described eight actions that central banks can initiate. The support to individual companies is often linked to the lender of last resort, an aspect dealt with in the next section. Basically, all market participants can initiate those actions.

4.5.2 Lender of last resort

In general, every market player can be a lender of last resort. However, governments, central banks and non-government organisations are often requested to provide liquidity. Faure and Heine (2013) suggest an additional party. Insurance companies might step-in as a lender of last resort if they are able to overcome the issues of predictability and moral hazard. The biggest problem is the lack of capacity of individual insurance companies to cope with the situation. Compared to natural or technological disasters, the affected population is not limited. This might be mitigated by the government as an insurer of last resort.

Liquidity is provided either to banks or to financed investors (Chapter 4.5.2.1). In addition, the lender of last resort might reduce foreign liquidity stress (Chapter 4.5.2.2).

4.5.2.1 Provision of liquidity to banks or to financed investors

Liquidity may be provided to banks to reduce their risk of insolvency. In unusual circumstances the US central bank is able to provide loans to non-banks (Cumming, 2013). Besides other measures, this action was tried during The Great Financial Crisis in 1929 (Galbraith, 1973). The additional liquidity should increase the cash flow of financed investors.

There are discussions about the scope and the design of mitigation measures. Goodhart and Huang (2005) show that central banks should only rescue banks that are “too big to fail”. A failure of a larger bank causes more financial contagion. They measure “too big” by the level of bank size, beyond which the risk would be too high for the central bank. In order to clarify the need to support banks, a policy framework is required systemically identifying important financial institutions (Hüpkes, 2013).

Different options exist to provide liquidity. Loans may be granted. In addition, illiquid assets may be swapped for high quality treasury bills to improve the liquidity position (Singh, 2011). Capital might be injected by recapitalisation (Borio et al., 2010; Cottarelli and Vinals, 2009; Panetta et al., 2009) but it might dilute existing shareholder rights (Laeven and Valencia, 2011; Panetta et al., 2009).

4.5.2.2 Provision of foreign liquidity to banks

Moreover, foreign exchange liquidity may be provided to local market participants to reduce foreign liquidity stress (Garcia and Nieto, 2013; Ghosh et al., 2009; Stone et al., 2011). Goldberg et al. (2011) examined the effects of currency swaps organised during the financial crisis in 2007 among more than 10 central banks and confirmed their success.

The last two sections introduced actions of the lender of last resort. The last category of containment actions can be initiated by governments and regulators. Their options are described in the next section.

4.5.3 Containment actions of governments and regulators

This section contains the containment actions that governments and regulators can take. Governments and regulators are able to define deposit insurance, grant guarantees and to nationalise injured market players (Chapter 4.5.3.1). In addition, they can initiate the actions of "Asset purchases programme", "Asset transfer programme", "Debt moratoria for financed investors", "Accounting discretion", "Deposit freezing or bank holidays" "Bank holidays on exchanges", "Stress tests" and "Prohibition of short sales". The last section shows a selection of resolution actions, which are, however, not in scope of this analysis.

4.5.3.1 Deposit insurance, guarantees and nationalisation

A guarantee makes the guarantor contractually committed to step-in to meet the obligations of another market participant if that party defaults on repayments (Singh and LaBrosse, 2011).

The deposits of bank clients are insured up to a specific limit (Cumming, 2013). The raising of the standard deposit insurance coverage limits alleviates the financial distress of banks (Garcia and Nieto, 2013). The money outflow from banks shall be contained (Goodhart, 2008). Demirgüç-Kunt et al. (2015) provided an overview when this kind of action was applied during financial crises. The creditworthiness of banks would, thus, increase. Deposit insurances might be granted to depositors of individual banks or the whole market (Borio et al., 2010; Cottarelli and Vinals, 2009; Panetta et al., 2009).

Additionally, debt guarantees may protect the banks' debts and bonds against default, thus adding to the creditworthiness of banks and reducing funding costs (Borio et al., 2010; Cottarelli and Vinals, 2009; Grande et al., 2013; Laeven and Valencia, 2011; Panetta et al., 2009). The guarantor can express the guarantee, which would then be noticed by markets or the guarantee could be implicit, which would it make harder to interpret (Singh, 2011). A blanket guarantee is synonymous with full depositor protection (Dell' Ariccia et al., 2008).

As a last step, nationalisation might also be an option (Singh and LaBrosse, 2011), which would, however, require relevant bankruptcy laws (Krueger, 2002).

4.5.3.2 Asset purchases programme

Asset programmes remove high risk assets from bank balance sheets to improve their liquidity situation (Borio et al., 2010; Cottarelli and Vinals, 2009; Panetta et al., 2009). Assets of distressed banks might be purchased to recapitalise them (Honohan, 2012). In this case, the purchase price needs to be higher than the book values (Panetta et al., 2009).

4.5.3.3 Asset transfer programme

Another option of governments and regulators is to transfer bad assets of banks to asset management companies (Klingebiel, 2000) called "bad banks" (Singh, 2011). This would increase the creditworthiness of the residual "good bank" (Deutsche Bundesbank, 2009).

4.5.3.4 Debt moratoria for financed investors

Debt moratoria may reduce the financial difficulties of financed parties, as loans already granted are not required to be repaid for a defined period of time (Calomiris et al., 2012; Friedman and Schwartz, 2007).

4.5.3.5 Accounting discretion

Banks are interested in overstated values of distressed assets during financial crises. Accounting discretion of banks might be an action to delay the depreciation of book values

(Calomiris et al., 2012; Huizinga and Laeven, 2012). The creditworthiness of banks would increase.

4.5.3.6 Deposit freezing or bank holidays

The tightening of money flows are traditional actions to calm financial crises. Deposit freezing or bank holidays reduce the risk of an extended money outflow in case of bank runs (Laeven and Valencia, 2010). The liquidity of banks would not be further drained under such circumstances, which can be seen as a relative increase in liquidity.

4.5.3.7 Bank holidays on exchanges

Bank holidays might also be applied for exchanges that strive to limit price fall (Galbraith, 1973), leading to a relative increase in asset prices. A less radical form is circuit breakers. Dealings are stopped when asset prices drop below a defined reference value. This action should prevent panic sales (Colesanti, 2010).

4.5.3.8 Stress tests

Knight (1921) distinguished between risk and uncertainty. Compared to uncertainty, risk is measurable. Taylor (2009) showed that uncertainty about the risk of other banks reduces interbank lending. Stress tests shall achieve transparency on the actual risk situation of banks. The test assesses, in particular, the capital adequacy of banks (Bank of England, 2013). Markets should restart without uncertainty (Claessens et al., 2011; Pritsker, 2012). In order to achieve this goal, the outcomes need to be disclosed to the markets (Bank of England, 2013).

4.5.3.9 Prohibition of short sales

Several countries banned or restricted naked and partly covered short sales of stocks during the last financial crisis in order to discourage speculation in falling prices (Frino et al., 2011; McMillan and Philip, 2012).

4.5.4 Resolution measures

The resolution phase, which is beyond the scope of this research, begins after the application of the immediate measures of financial crisis containment. Different measures may be applied in order to lead the market participants and the overall economy back to economic growth and health.

Borio et al. (2010) discuss the replacement of the board, disposal of branches, restriction on dividend payments, limits on compensation, cost-cutting measures and financial steps, including the restructuring of funding or additional lending requirements. The closure of financial institutions could be the ultimate move. The closure seeks to bring assets and liabilities back to markets under new ownership (Lindgren, 2012). In addition, the government might introduce tax incentives for loan-loss write-offs, which help to restructure balance sheets of banks and market lending (Calomiris et al., 2012).

Nine containment actions that can be initiated by governments and regulators were described in the previous pages. Together with the central bank and lenders of last resort, twenty actions can be applied. The next section consolidates all identified elements and interrelations into a combined systemic financial crisis model.

4.6 Combined financial crisis model

The previous sections of Chapter 4 describe theories about financial crises, financial markets and financial crisis containment. In order to ensure a holistic picture all elements and interrelations documented in these sections need to be combined. A systemic analysis can be conducted afterwards (see Chapter 5).

Chapter 4.6.1 lists all the 28 identified elements. Chapter 4.6.2 shows their local environment, including their ingoing and outgoing interrelations from and to other elements. The overview starts with Element 1 “Asset demand” and ends with Element 28 “Money supply”. Each examination contains a graphic. The examined element is highlighted in grey. All outgoing interrelations to other elements are shown on the left-hand side and all incoming interrelations from other elements are shown on the right-hand side.

The subsequent sections combine all identified elements and 61 interrelations described in Chapters 4.1, 4.2, 4.3, 4.4 and 4.5 into a global perspective. Chapter 4.6.3 visualises the systemic model and the mathematical representation of the combined model is dealt with in Chapter 4.6.4.

While Chapter 3.3.1 shows the assumptions of the modelling approach Chapter 4.6.5 defines content-related assumptions of the developed model.

4.6.1 Elements of the developed financial crisis model

This section lists and describes all 28 elements of the developed systemic financial crisis model. Table 4-2 shows the details.

Table 4-2: Elements of the developed systemic financial crisis model

#	Element	Description
1	Asset demand	Amount of assets to be purchased measured in value of money per asset
2	Asset supply	Amount of assets to be sold measured in value of money per asset
3	Asset price	Amount of money given by a purchaser to a seller for an asset measured in value of money per asset
4	Expected risk of asset	Amount of potential lost money in an investment measured in measured in percent
5	Expected return of asset	Amount of money to be received from an investment measured in percent
6	Asset risk-return ratio	Expected return for a specific amount of risk of an asset measured in a ratio (percent)
7	Market risk-return ratio	Reference ratio for expected returns for a specific amount of risk from markets measured in a ratio (percent)
8	Attractiveness of asset	Asset's attractiveness compared to other investments measured in degree
9	General rate of interest	Interest rate for debts from central banks measured in percent.
10	Costs of new loans	Individual interest rate of financed investor measured in percent
11	Attractiveness of financed investments	Difference between costs for new loans and expected return of asset measured in percent
12	New loans for investments	New granted loans to finance asset purchases measured in amount of money
13	Creditworthiness of financed investors	Aggregated view on assets and debts of the financed investor measured in degree
14	Payments for new loans	Interest and principal payments of financed investors for new loans measured in amount of money
15	Risk of debt default	Threat of missing principal and interest payments measured in percent
16	Loans for investments	Overall amount of granted loans to finance asset purchases measured in value of money
17	Asset cash flow	Balance of expected incoming asset returns and outgoing payments for loans measured in value of money
18	Payments for loans	Interest and principal payments of the financed investor for all loans measured in value of money
19	Liquidity of banks	Amount of liquid money of banks measured in value of money
20	Euphoria	Irrational exaggerated expectations of price developments measured in degree
21	Short sale	Selling of assets with the intention to purchase them back at lower prices measured in value of money
22	Risk of misbehaviour	Incentive to accept high short-term returns for high long-term risks by the management of the asset measured in percent
23	Risk of contagion	Infection rate of illiquidity, which is transferred from one party to another measured in percent
24	Creditworthiness of banks	Reputation of banks to be liquid measured in degree
25	Uncertainty	Immeasurable risk of bank defaults measured in percent
26	Interbank lending	Amount of debts granted among banks measured in value of money
27	Foreign exchange rate	Purchasing power of domestic currency measured in value of foreign money per one unit of domestic money
28	Money supply	Amount of money available in a country measured in value of money

4.6.2 Local environment of elements

The previous section outlined the elements involved in the developed system. This second section shows for all elements their local environment taking into account ingoing and outgoing interrelations.

Table 4-3: Local environment of Element 1 "Asset demand"

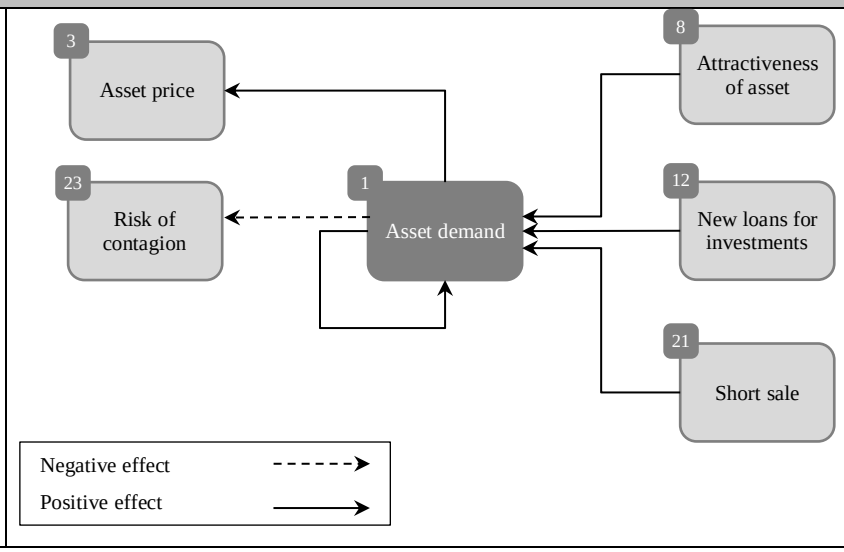
Local environment of Element 1 “Asset demand”	
In-degree: 4 Out-degree: 3	

Table 4-4: Local environment of Element 2 “Asset supply”

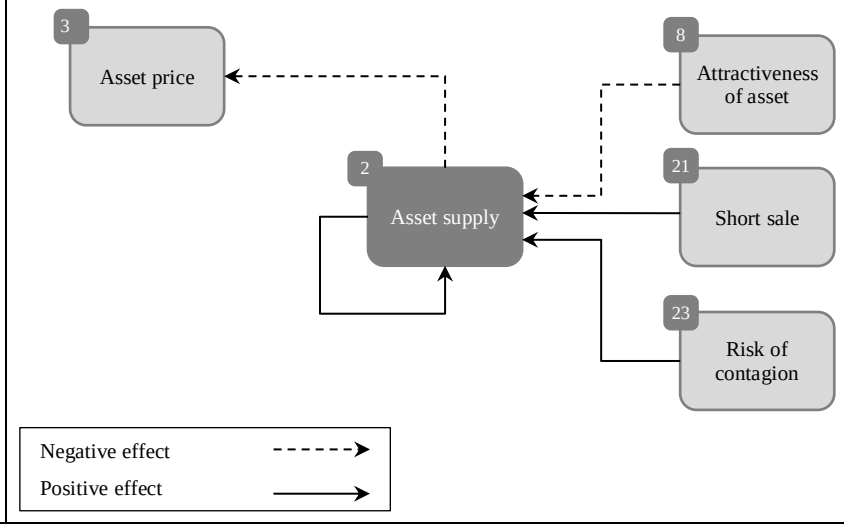
Local environment of Element 2 “Asset supply”	
In-degree: 4 Out-degree: 2	

Table 4-5: Local environment of Element 3 "Asset price"

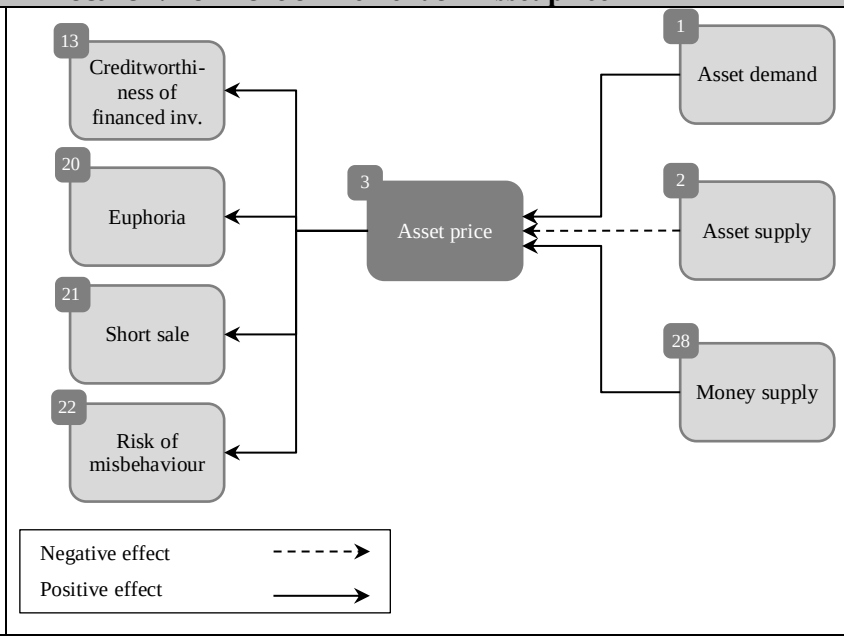
Local environment of Element 3 "Asset price"	
In-degree: 3 Out-degree: 4	

Table 4-6: Local environment of Element 4 "Expected risk of asset"

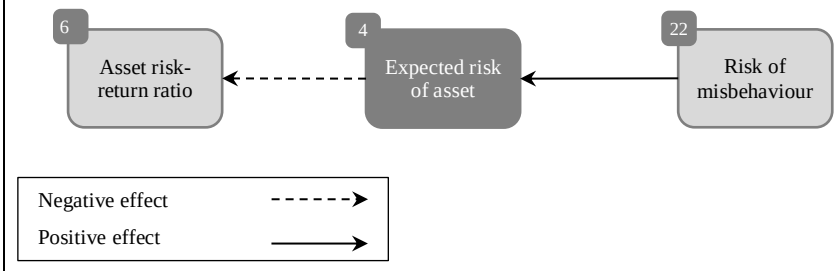
Local environment of Element 4 "Expected risk of asset"	
In-degree: 1 Out-degree: 1	

Table 4-7: Local environment of Element 5 "Expected return of asset"

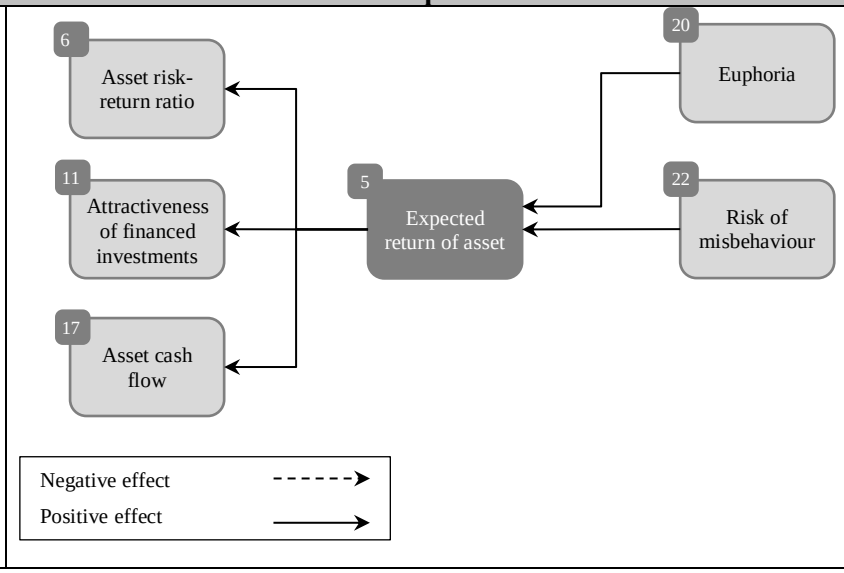
Local environment of Element 5 "Expected return of asset"	
In-degree: 2 Out-degree: 3	

Table 4-8: Local environment of Element 6 "Asset risk-return ratio"

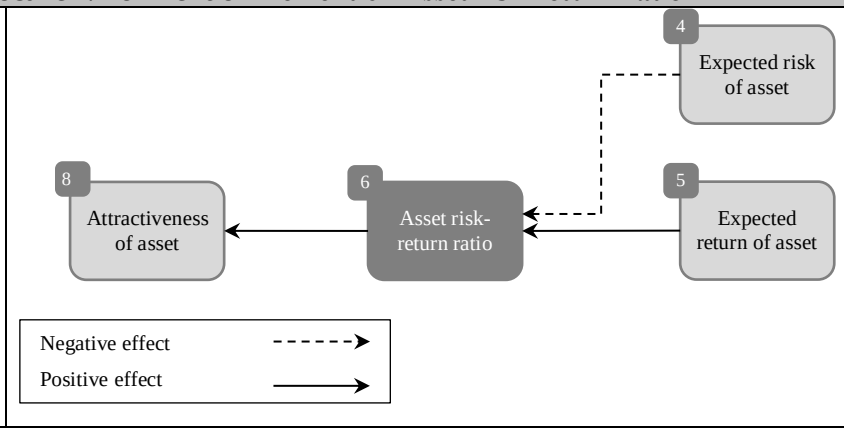
Local environment of Element 6 "Asset risk-return ratio"	
In-degree: 2 Out-degree: 1	

Table 4-9: Local environment of Element 7 "Market risk-return ratio"

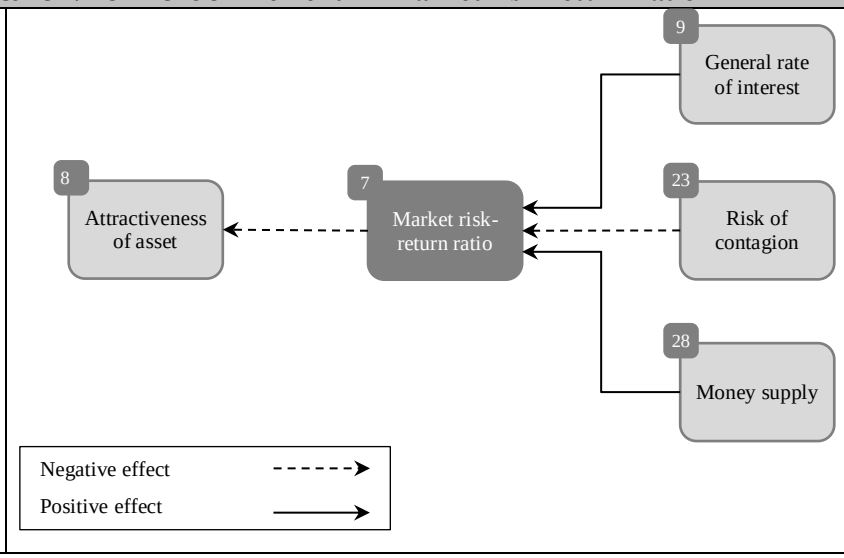
Local environment of Element 7 "Market risk-return ratio"	
In-degree: 3 Out-degree: 1	

Table 4-10: Local environment of Element 8 "Attractiveness of asset"

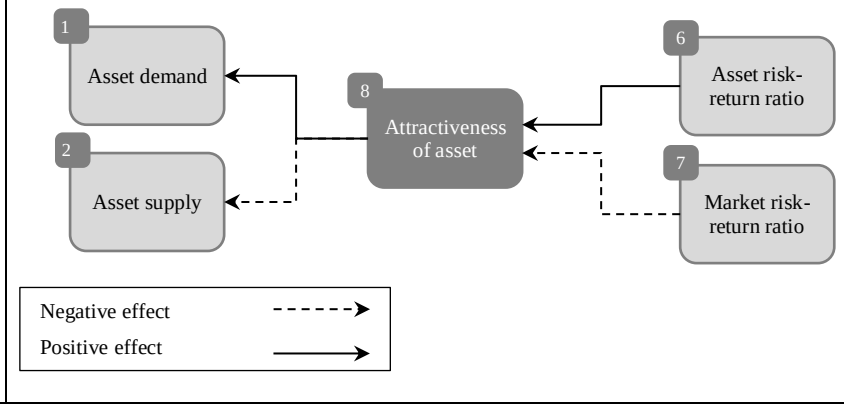
Local environment of Element 8 "Attractiveness of asset"	
In-degree: 2 Out-degree: 2	

Table 4-11: Local environment of Element 9 "General rate of interest"

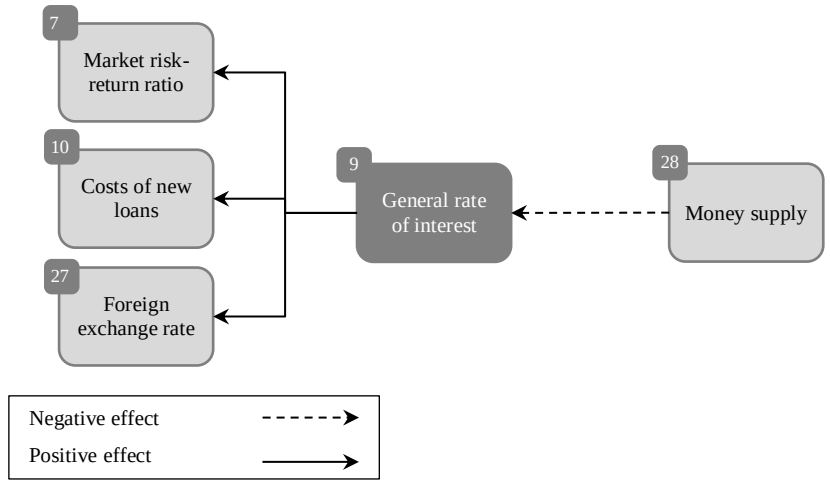
Local environment of Element 9 "General rate of interest"	
In-degree: 1 Out-degree: 3	

Table 4-12: Local environment of Element 10 "Costs of new loans"

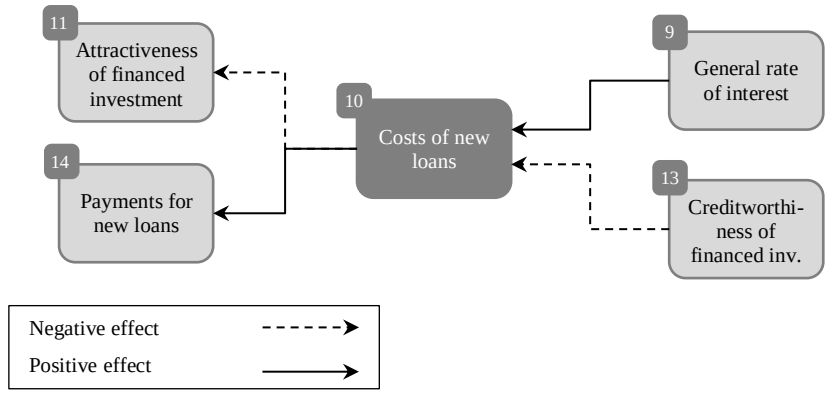
Local environment of Element 10 "Costs of new loans"	
In-degree: 2 Out-degree: 2	

Table 4-13: Local environment of Element 11 "Attractiveness of financed investments"

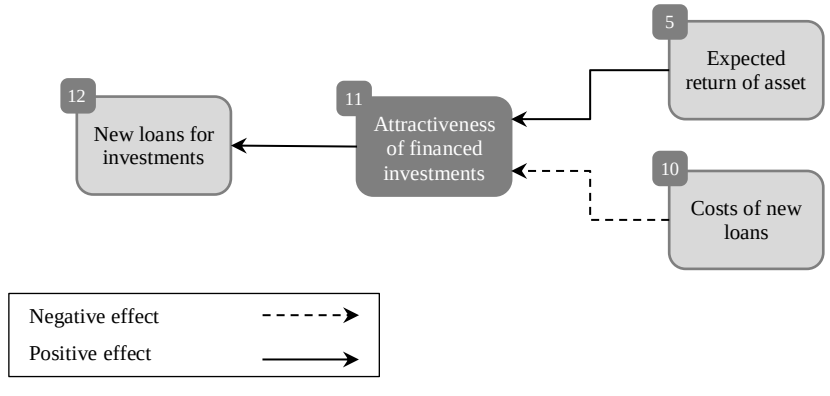
Local environment of Element 11 "Attractiveness of financed investments"	
In-degree: 2 Out-degree: 1	

Table 4-14: Local environment of Element 12 "New loans for investments"

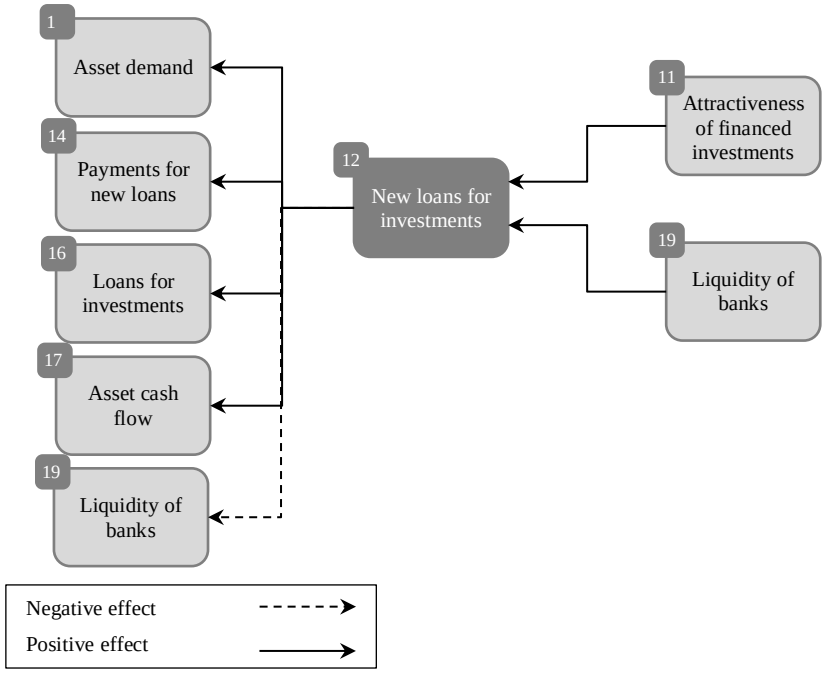
Local environment of Element 12 "New loans for investments"	
In-degree: 2 Out-degree: 5	

Table 4-15: Local environment of Element 13 "Creditworthiness of financed investors"

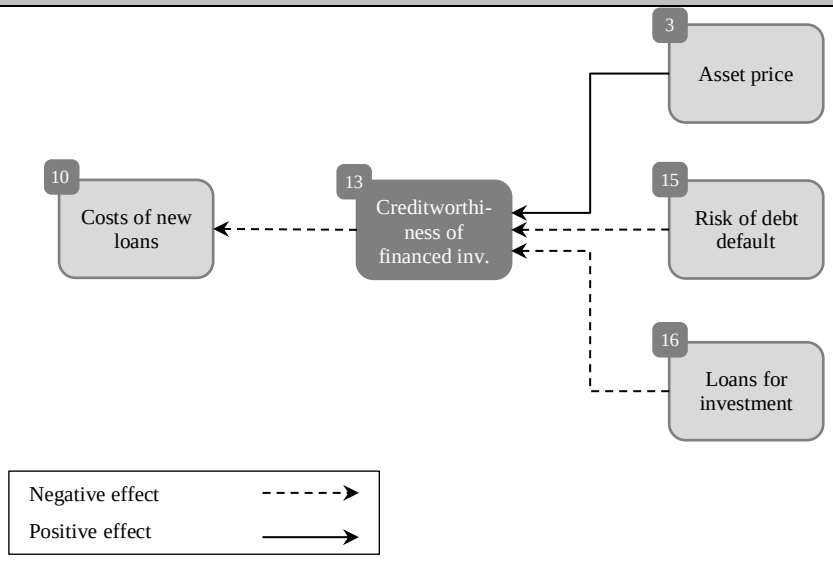
Local environment of Element 13 "Creditworthiness of financed investors"	
In-degree: 3 Out-degree: 1	

Table 4-16: Local environment of Element 14 "Payments for new loans"

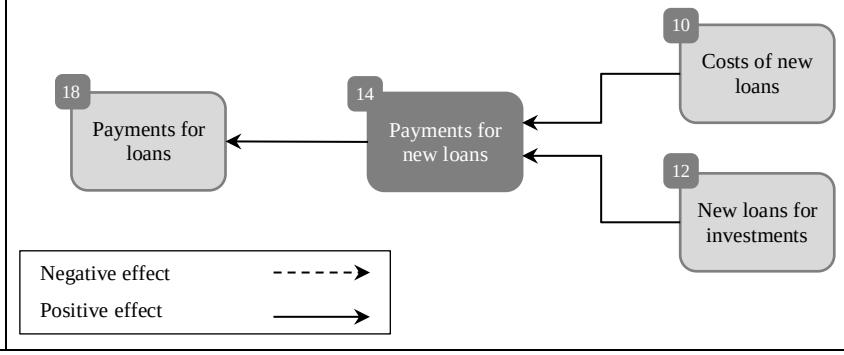
Local environment of Element 14 "Payments for new loans"	
In-degree: 2 Out-degree: 1	

Table 4-17: Local environment of Element 15 "Risk of debt default"

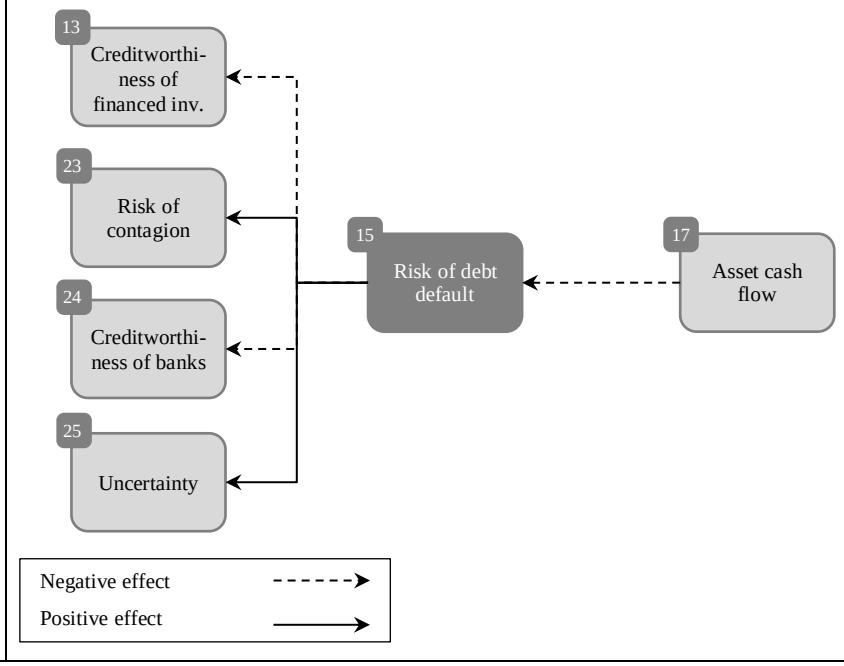
Local environment of Element 15 "Risk of debt default"	
In-degree: 1 Out-degree: 4	

Table 4-18: Local environment of Element 16 "Loans for investments"

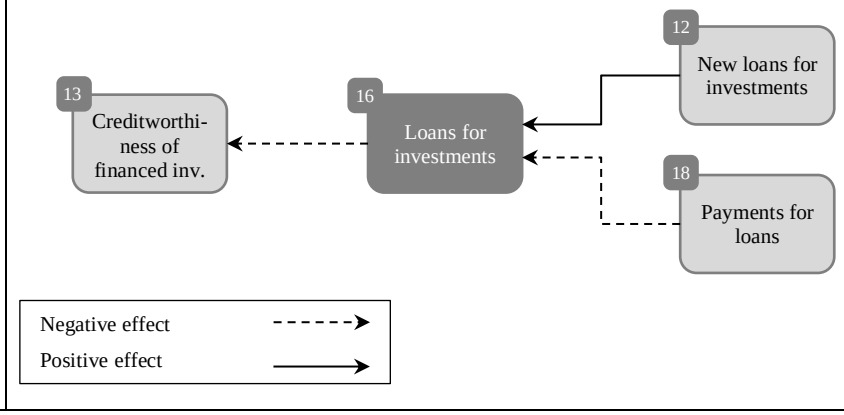
Local environment of Element 16 "Loans for investments"	
In-degree: 2 Out-degree: 1	

Table 4-19: Local environment of Element 17 "Asset cash flow"

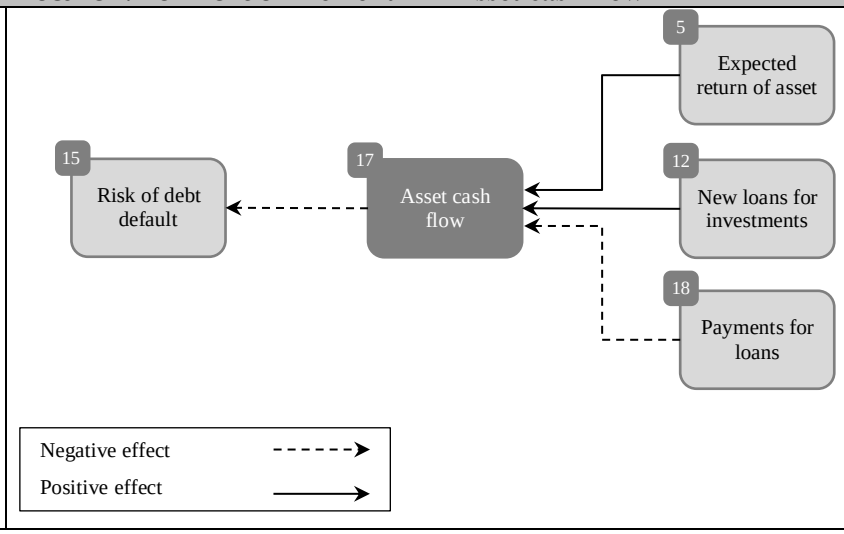
Local environment of Element 17 "Asset cash flow"	
In-degree: 3 Out-degree: 1	

Table 4-20: Local environment of Element 18 "Payments for loans"

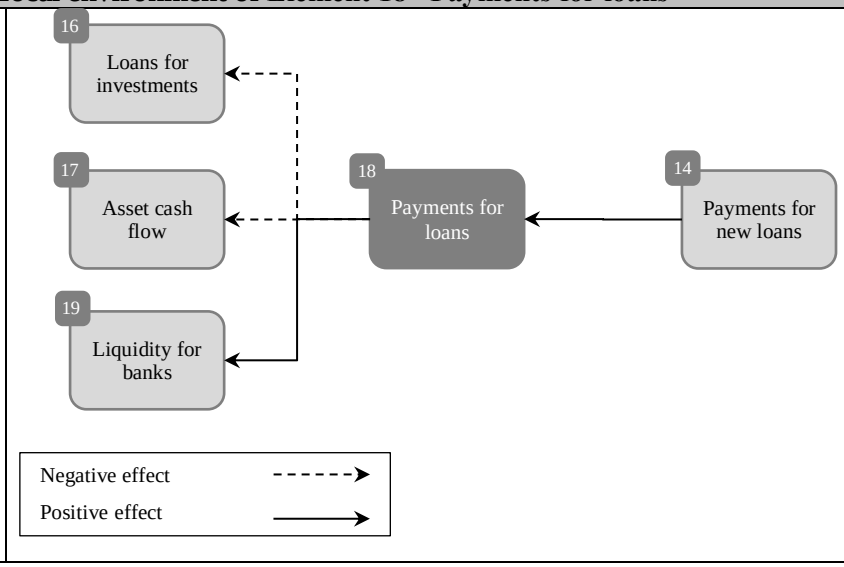
Local environment of Element 18 "Payments for loans"	
In-degree: 1 Out-degree: 3	

Table 4-21: Local environment of Element 19 "Liquidity of banks"

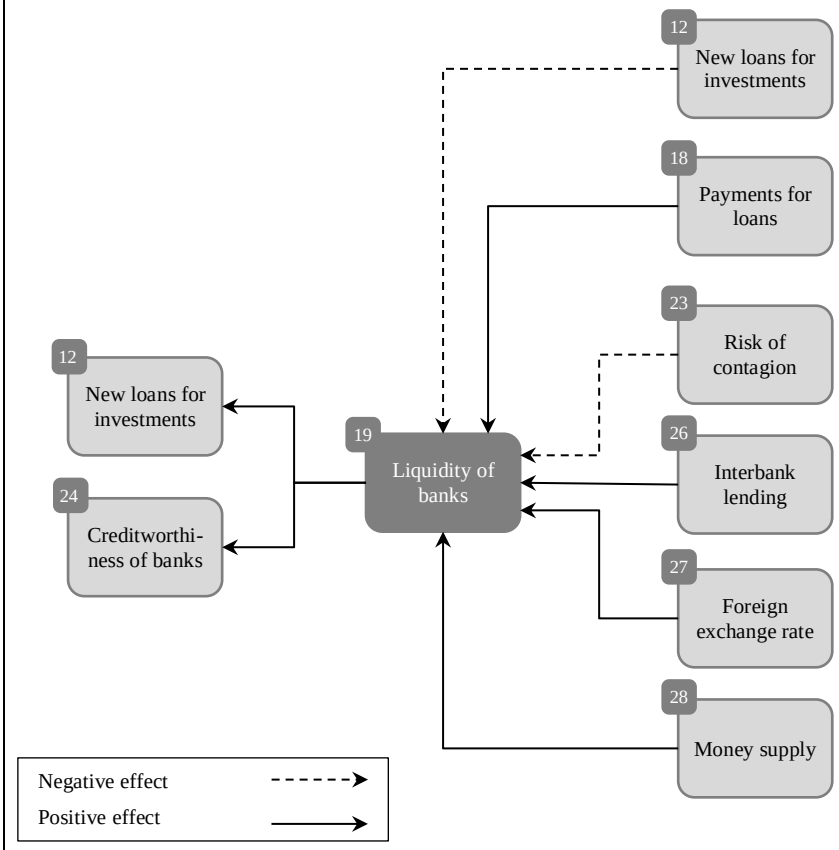
Local environment of Element 19 "Liquidity of banks"	
In-degree: 6 Out-degree: 2	

Table 4-22: Local environment of Element 20 "Euphoria"

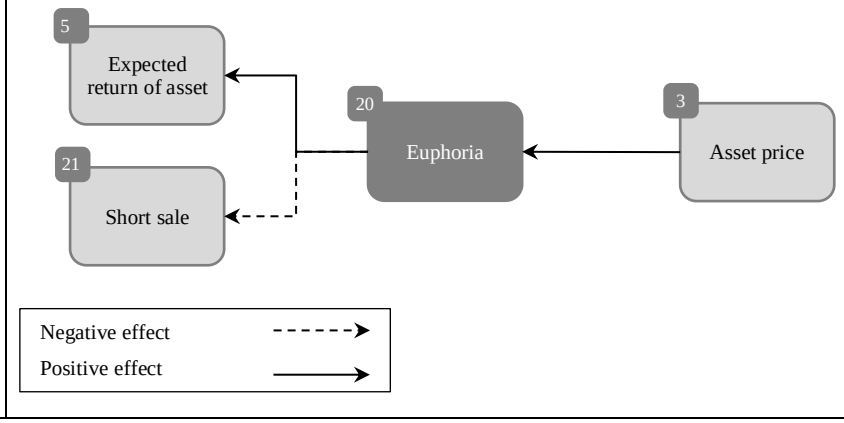
Local environment of Element 20 "Euphoria"	
In-degree: 1 Out-degree: 2	

Table 4-23: Local environment of Element 21 "Short sale"

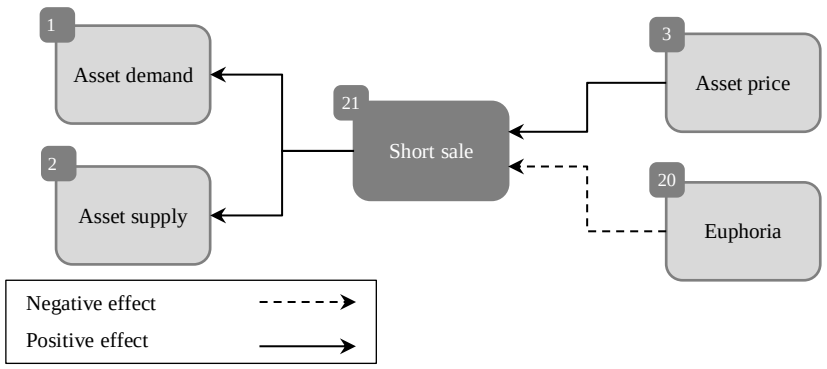
Local environment of Element 21 "Short sale"	
In-degree: 2 Out-degree: 2	

Table 4-24: Local environment of Element 22 "Risk of misbehaviour"

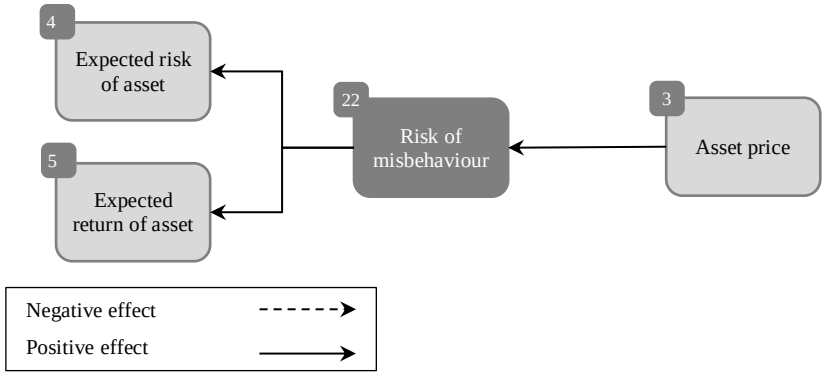
Local environment of Element 22 "Risk of misbehaviour"	
In-degree: 1 Out-degree: 2	

Table 4-25: Local environment of Element 23 "Risk of contagion"

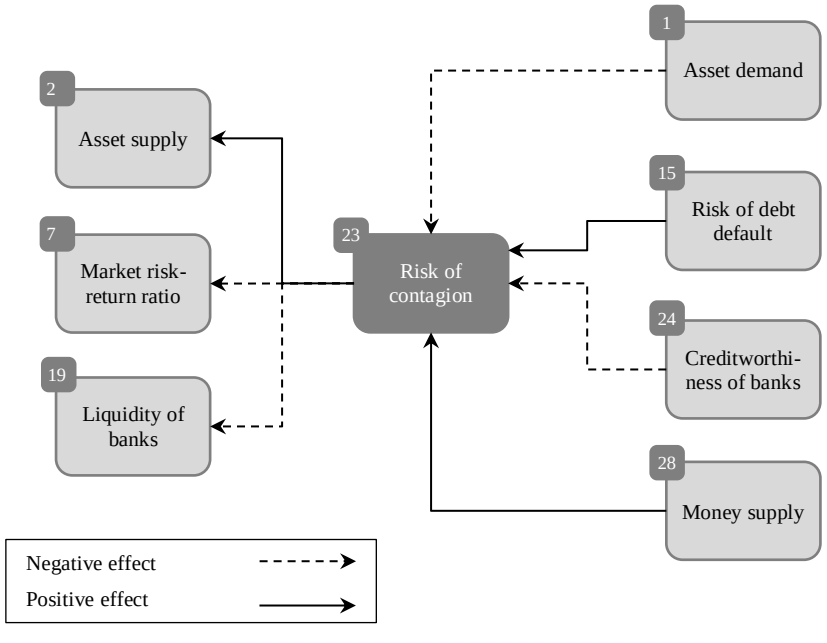
Local environment of Element 23 "Risk of contagion"	
In-degree: 4 Out-degree: 3	

Table 4-26: Local environment of Element 24 "Creditworthiness of banks"

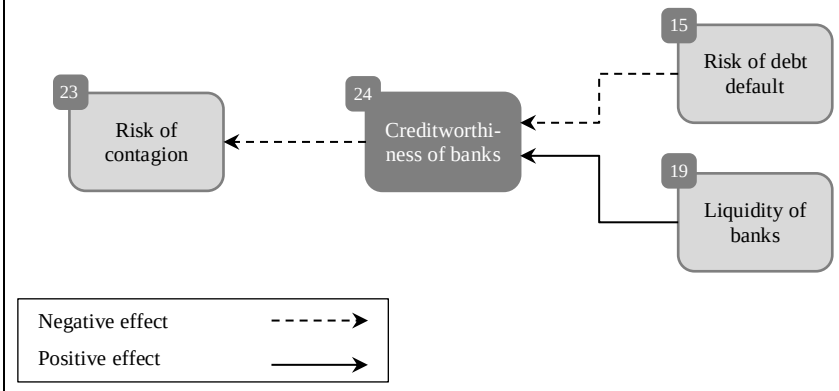
Local environment of Element 24 "Creditworthiness of banks"	
In-degree: 2 Out-degree: 1	

Table 4-27: Local environment of Element 25 "Uncertainty"

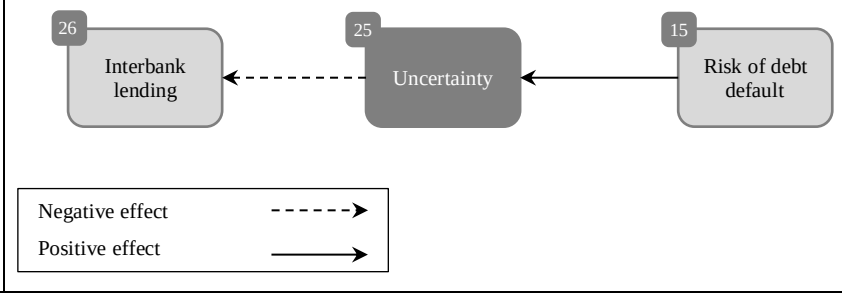
Local environment of Element 25 "Uncertainty"	
In-degree: 1 Out-degree: 1	

Table 4-28: Local environment of Element 26 "Interbank lending"

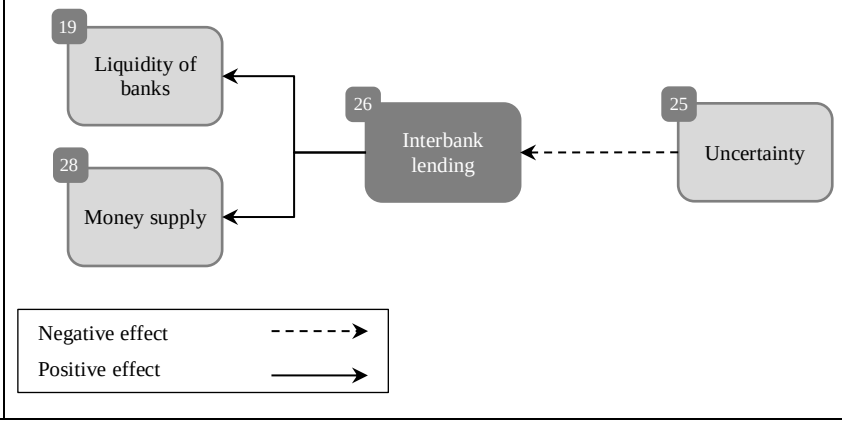
Local environment of Element 26 "Interbank lending"	
In-degree: 1 Out-degree: 2	

Table 4-29: Local environment of Element 27 "Foreign exchange rate"

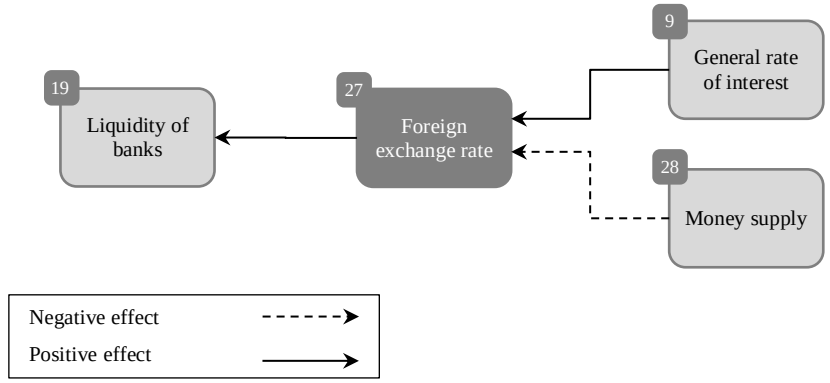
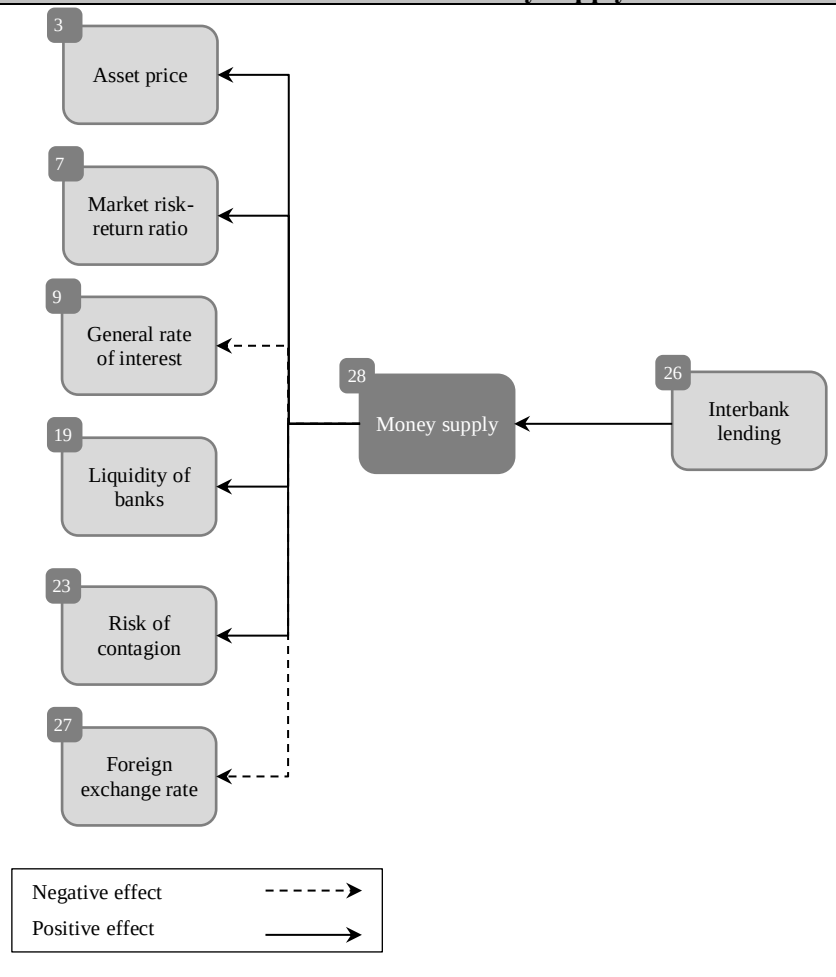
Local environment of Element 27 "Foreign exchange rate"	
In-degree: 2 Out-degree: 1	

Table 4-30: Local environment of Element 28 "Money supply"

Local environment of Element 28 "Money supply"	
In-degree: 1 Out-degree: 6	

4.6.3 Visualised financial crisis model

The two preceding sections listed all elements of the system and their local interrelations. This chapter visualises all elements and interrelations globally.

Figure 4-16 illustrates the modelling approach differentiating three modelling levels. Figure 4-17 is the most important result of the systemic modelling. It shows all elements and interrelations of the developed financial crisis system. Figure 4-18, Figure 4-19, Figure 4-20, Figure 4-21 and Figure 4-22 highlight the elements involved in each stage of financial crises introduced in Chapter 2.2.2.

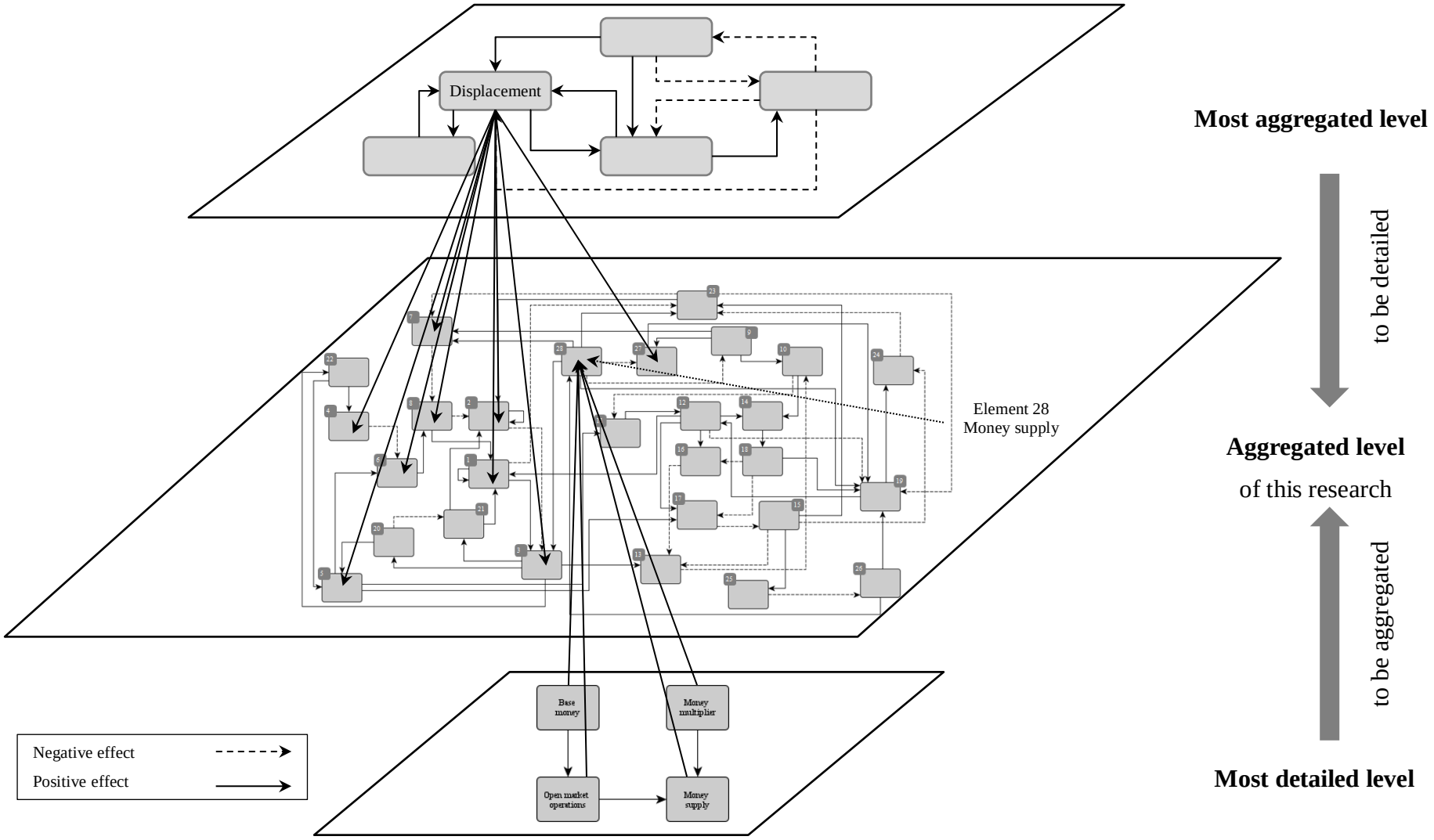


Figure 4-16: Illustration of modelling approach considering different modelling levels

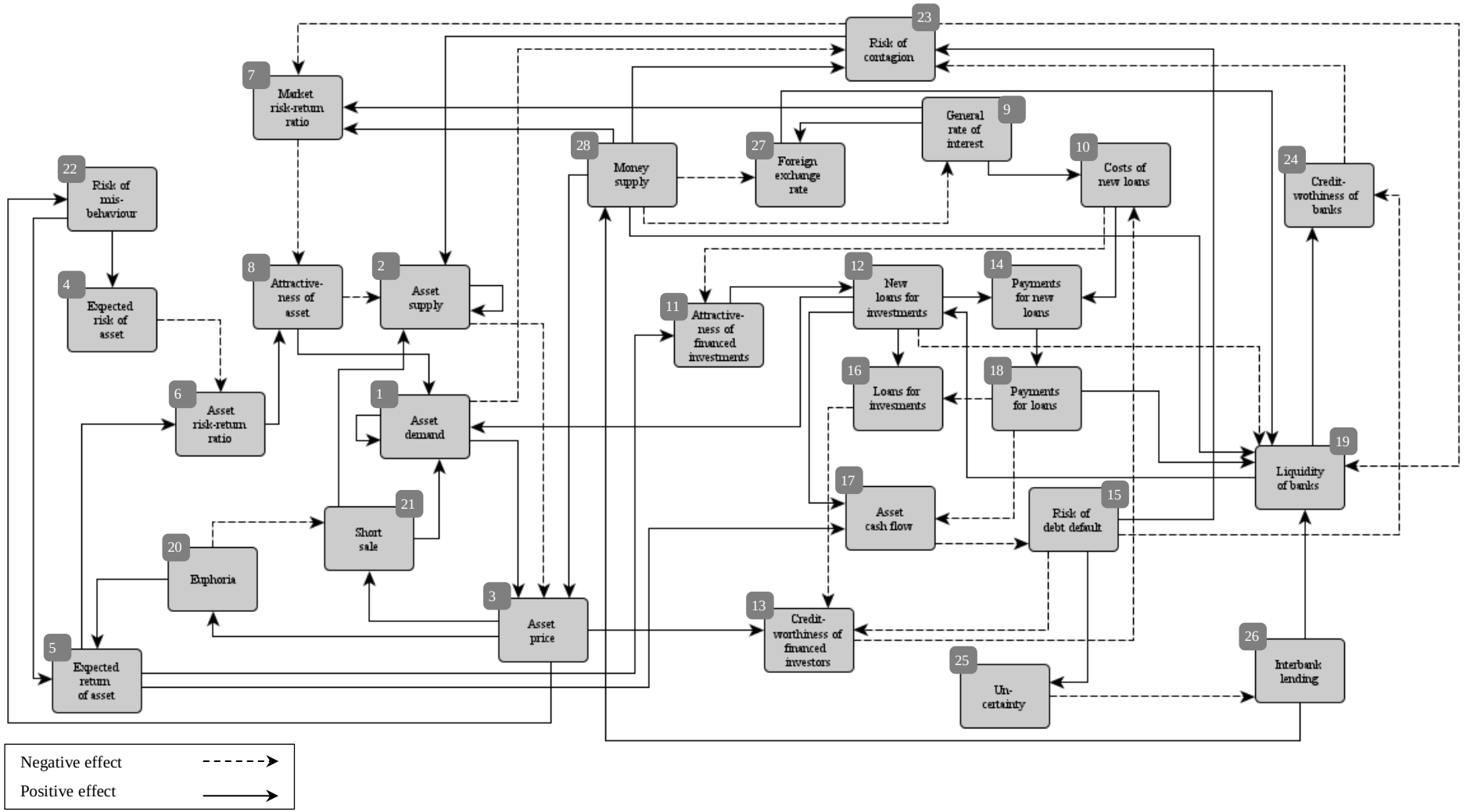


Figure 4-17: Impact graph of financial crises

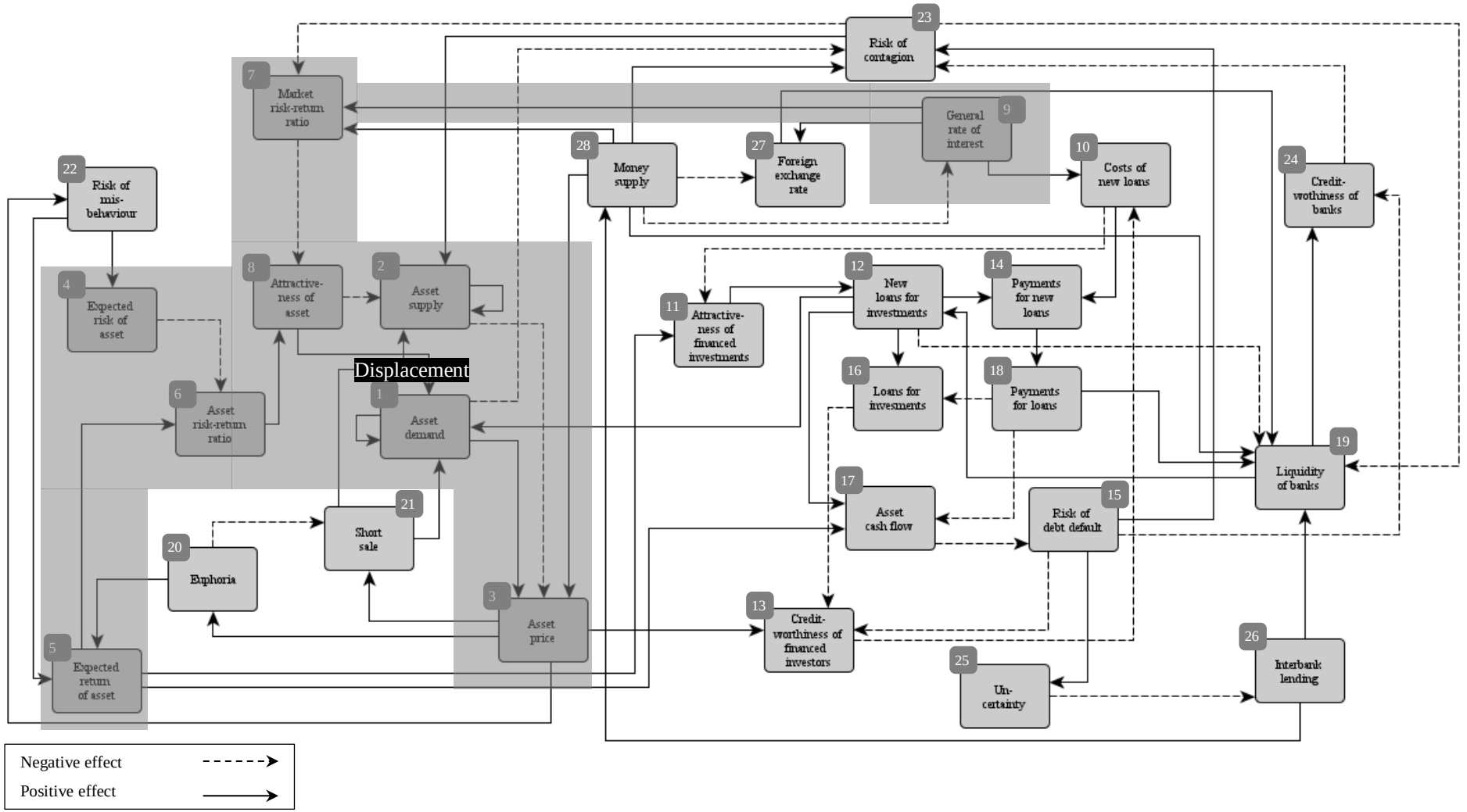


Figure 4-18: Elements of the stage "Displacement"

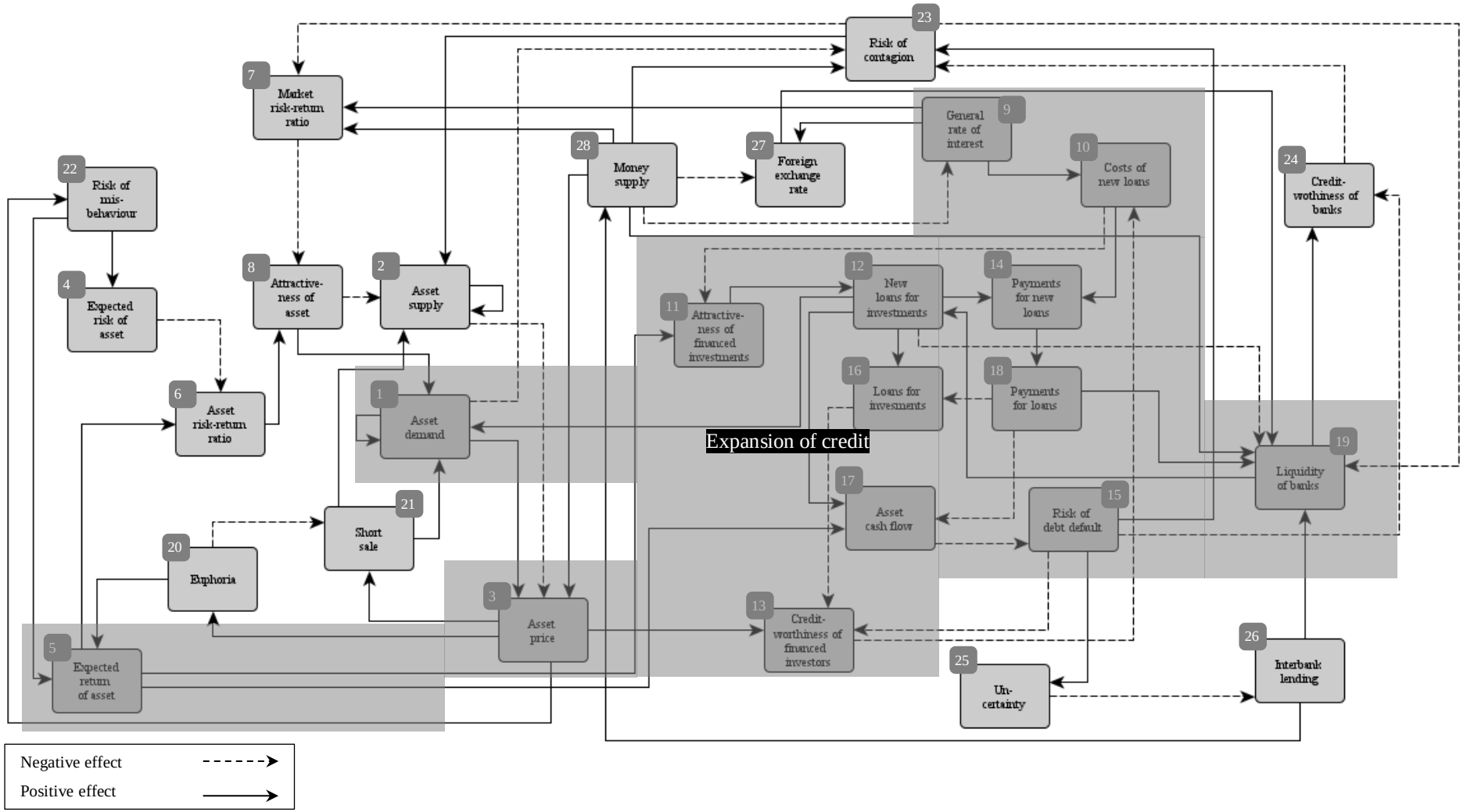


Figure 4-19: Elements of the stage "Expansion of credit"

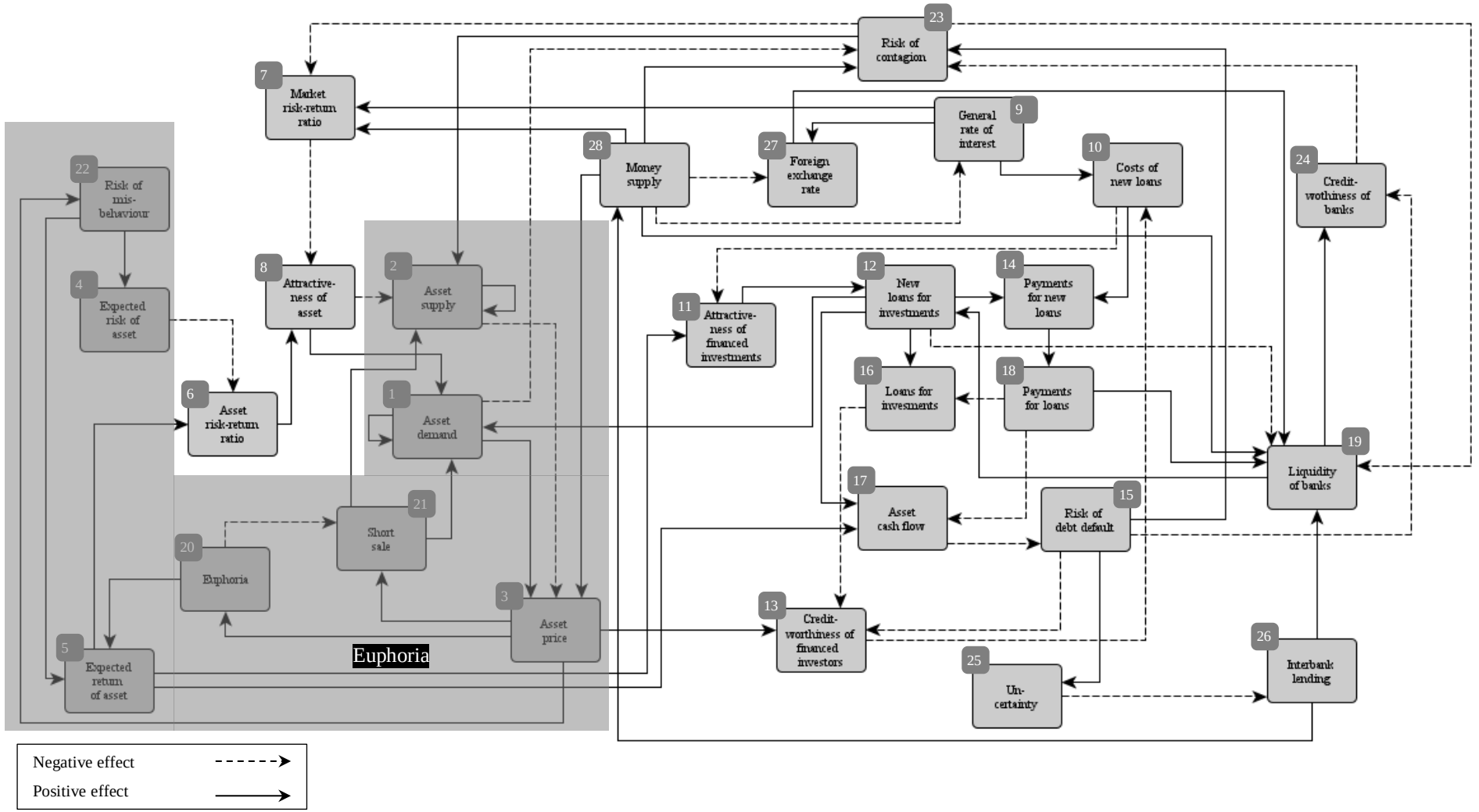


Figure 4-20: Elements of the stage "Euphoria"

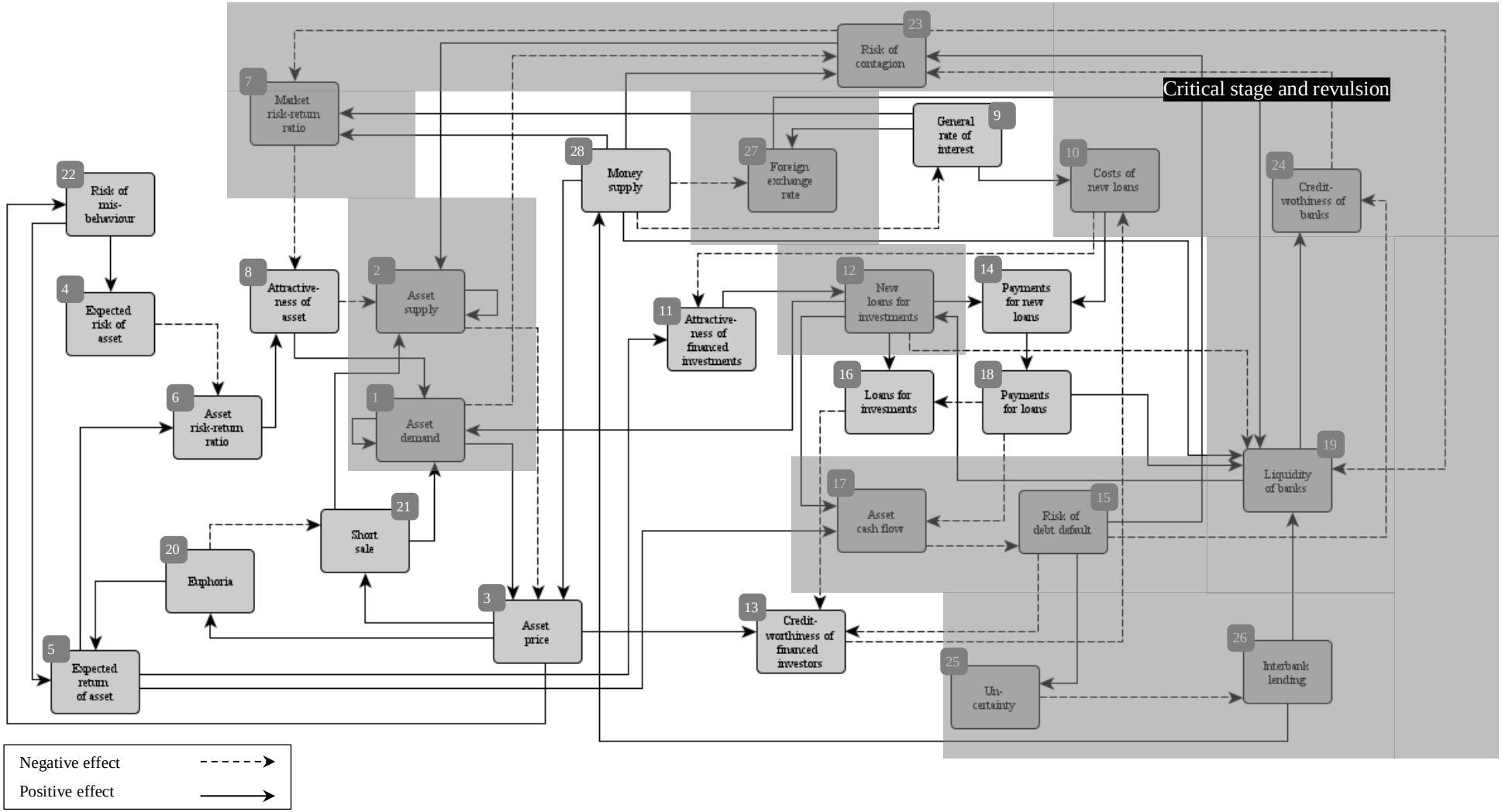


Figure 4-21: Elements of the stage "Critical stage and revulsion"

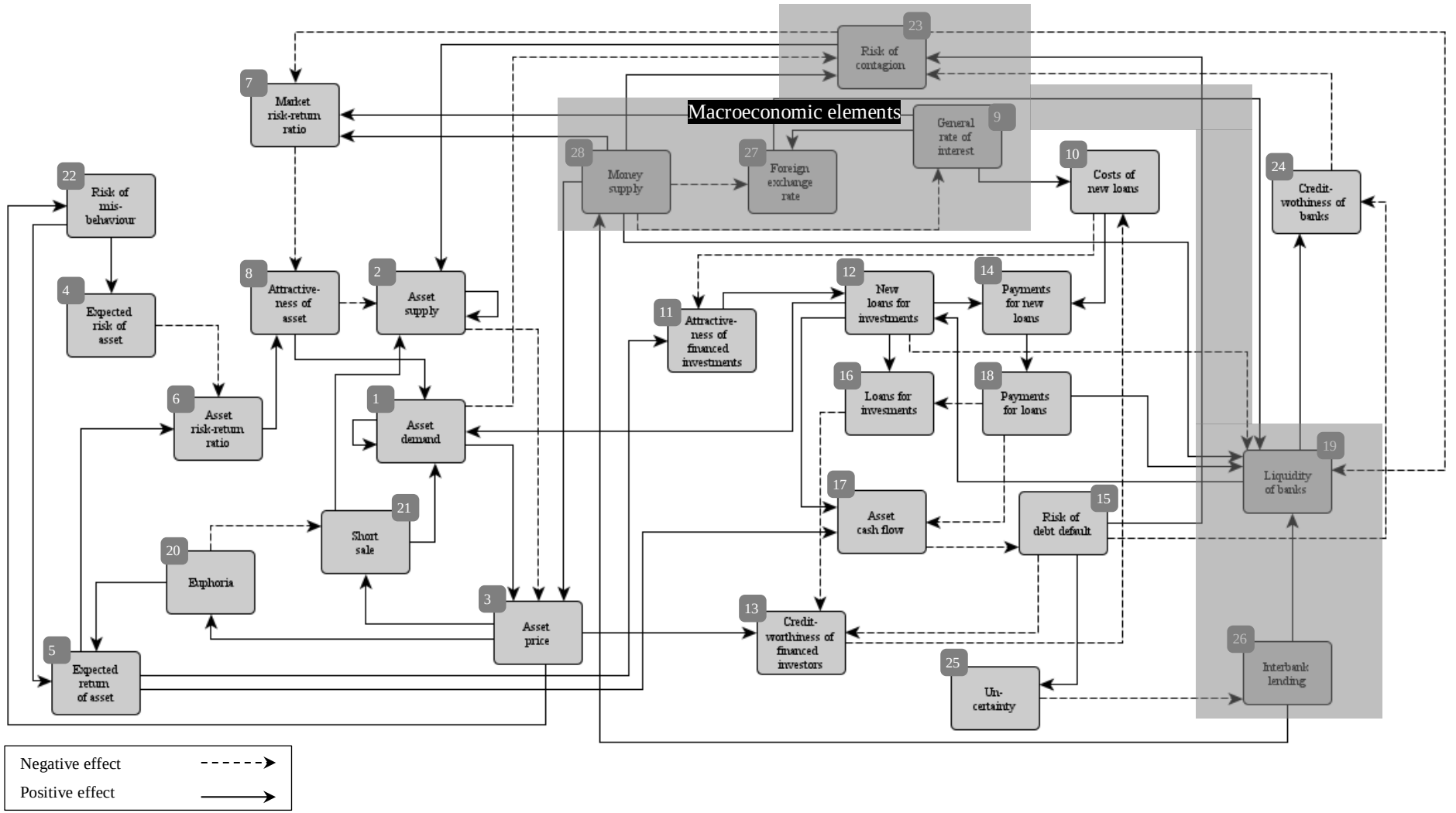


Figure 4-22: Macroeconomic elements

4.6.4 Mathematical description of financial crisis model

The last section provided a combined view on the developed model. In order to analyse them quantitatively, they need to be mathematically described. This is the aim of this section. It contains the adjacency matrix and the impact matrix, including the reasoning for their values.

The adjacency matrix is a mathematical representation of a graph visualising complex systems (Brand, 2013). The background is dealt with in Chapter 2.1.3. The adjacency matrix of the developed financial crisis model is shown in Figure 4-23.

The modelling approach of Vester (2007) considers the intensity of the interrelations that are documented in an impact matrix. The scheme of the matrix is identical to the adjacency matrix. However, the matrix contains additional information. The available interrelations are not only described by a simple 1 (or -1 in case of negative interrelations). They are weighted and can be seen as discrete form of correlation between elements. The intensity of an existing interrelation is modelled on a scale of 1 to 3 differentiating positive or negative effects by negative and positive numbers:

- 1 or -1: weak interrelation
- 2 or -2: standard interrelation
- 3 or -3: strong interrelation.

The starting point is always a standard interrelation. In the absence of any specific information about interrelations it is assumed that the effect of the interrelation is neither weak nor strong. A standard interrelation is characterised by a transfer of the impulse of the source element without any reduction or amplification. A weak interrelation means a change in a source element leads merely to minor changes in the receiving element. A strong interrelation describes that a change in a source element leads to major changes in the receiving element.

There are deviations from the standard value in the following cases.

Table 4-31: Deviations of the impact matrix from the standard value

Interrelation from-to	Deviation	Reason
1: Asset demand - 1: Asset demand	Intensity: weak (1) instead of standard (2)	Herd behaviour does not dominate investment decisions.
1: Asset demand - 23: Risk of contagion	Intensity: weak (-1) instead of standard (-2)	For interrelations between a single asset and the whole market a weak relation is considered.
2: Asset supply - 2: Asset supply	Intensity: weak (1) instead of standard (2)	Herd behaviour does not dominate investment decisions.
12: New loans for investments - 17: Asset cash flow	Intensity: weak (1) instead of standard (2)	Only a part of the financed investors are Ponzi investors and repay existing debts with new debts.
12: New loans for investments - 19: Liquidity of banks	Intensity: weak (-1) instead of standard (-2)	For interrelations between a single debt of a financed investor and the whole bank a weak relation is considered.
15: Risk of debt default - 23: Risk of contagion	Intensity: weak (1) instead of standard (2)	For interrelations between a single debt of a financed investor and the whole market a weak relation is considered.
15: Risk of debt default - 24: Creditworthiness of banks	Intensity: weak (-1) instead of standard (-2)	For interrelations between a single debt of a financed investor and the whole bank a weak relation is considered.
15: Risk of debt default - 25: Uncertainty	Intensity: weak (1) instead of standard (2)	For interrelations between a single debt of a financed investor and the whole market a weak relation is considered.
28: Money supply - 23: Risk of contagion	Intensity: weak (1) instead of standard (2)	The fear of inflation results in a higher risk of contagion, which is partly equalised by more expected liquidity.

The impact matrix of the developed financial crisis model is shown in Figure 4-24.

In this research the information about positive or negative interrelations is important and serves as a basis for all analyses. The strength of an interrelation is only relevant for the analysis of the systemic role of elements (see Chapter 3.3.3). Other methods of the analysis do not require such of information.

Adjacency matrix

from \ to	Elements	1 Asset demand	2 Asset supply	3 Asset price	4 Expected risk of asset	5 Expected return of asset	6 Asset risk-return ratio	7 Market risk-return ratio	8 Attractiveness of asset	9 General rate of interest	10 Costs of new loans	11 Attractiveness of financed investments	12 New loans for investments	13 Creditworthiness of financed investors	14 Payments for new loans	15 Risk of debt default	16 Loans for investments	17 Asset cash flow	18 Payments for loans	19 Liquidity of banks	20 Euphoria	21 Short sale	22 Risk of misbehaviour	23 Risk of contagion	24 Creditworthiness of banks	25 Uncertainty	26 Interbank lending	27 Foreign exchange rate	28 Money supply
1	Asset demand	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2	Asset supply	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Asset price	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
4	Expected risk of asset	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Expected return of asset	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
6	Asset risk-return ratio	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Market risk-return ratio	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Attractiveness of asset	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	General rate of interest	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
10	Costs of new loans	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Attractiveness of financed investments	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	New loans for investments	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
13	Creditworthiness of financed investors	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Payments for new loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
15	Risk of debt default	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
16	Loans for investments	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Asset cash flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Payments for loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
19	Liquidity of banks	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
20	Euphoria	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
21	Short sale	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Risk of misbehaviour	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Risk of contagion	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
24	Creditworthiness of banks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
25	Uncertainty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
26	Interbank lending	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
27	Foreign exchange rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
28	Money supply	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0

Figure 4-23: Mathematical description of financial crisis model – Adjacency matrix

Impact matrix

from	Elements	to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Asset demand	Asset supply	Asset price	Expected risk of asset	Expected return of asset	Asset risk-return ratio	Market risk-return ratio	Attractiveness of asset	General rate of interest	Costs of new loans	Attractiveness of financed investments	New loans for investments	Creditworthiness of financed investors	Payments for new loans	Risk of debt default	Loans for investments	Asset cash flow	Payments for loans	Liquidity of banks	Euphoria	Short sale	Risk of misbehaviour	Risk of contagion	Creditworthiness of banks	Uncertainty	Interbank lending	Foreign exchange rate	Money supply
1	Asset demand	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0
2	Asset supply	0	1	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Asset price	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0
4	Expected risk of asset	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Expected return of asset	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
6	Asset risk-return ratio	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Market risk-return ratio	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Attractiveness of asset	2	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	General rate of interest	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
10	Costs of new loans	0	0	0	0	0	0	0	0	0	0	-2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Attractiveness of financed investments	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	New loans for investments	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	-1	0	0	0	0	0	0	0	0	0
13	Creditworthiness of financed investors	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Payments for new loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
15	Risk of debt default	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	1	-1	1	0	0	0
16	Loans for investments	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Asset cash flow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Payments for loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-2	0	2	0	0	0	0	0	0	0	0	0
19	Liquidity of banks	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
20	Euphoria	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0
21	Short sale	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	Risk of misbehaviour	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	Risk of contagion	0	2	0	0	0	0	-2	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0	0	0	0
24	Creditworthiness of banks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0
25	Uncertainty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	0	0
26	Interbank lending	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
27	Foreign exchange rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
28	Money supply	0	0	2	0	0	0	2	0	-2	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	-2	0

Figure 4-24: Mathematical description of financial crisis model – Impact matrix

4.6.5 Assumptions of the systemic financial crisis model

Assumptions of the financial crisis model and those of the modelling approach need to be differentiated. This sub-chapter describes the assumptions of the financial crisis model. Chapter 3.3.1 describes the assumptions of the applied methodological approach. This section contains aspects of the environment of the developed system and assumptions within the system.

The developed model represents one currency area of a country or an union of countries surrounded by other currency areas, which can be described by the same model. However, the focus of this research is the general analysis of actions. Dependencies, caused by interrelations to other currency areas, are out of scope. Therefore, the system is closed from a modelling perspective. The model does not show interrelations from elements outside of the system to elements within the system. However, some elements within the system can be influenced from the outside. This is obvious in case of the interplay of currencies. Other currencies are linked to the floating Element "Foreign exchange rate". In addition, the Element "Risk of contagion" can be increased or decreased by rumours from outside the system. The same can happen for the Element "Euphoria". Any bank run in another currency areas might lead to a decrease of the Elements "Creditworthiness of banks" or the "Interbank lending" and the Element "Uncertainty" might increase. Even the asset pricing is affected. The Element "Market risk-return ratio" reflects the optimal relation of risk and return for investors. Any boom in another area might increase this element. Investment decision (i.e. Elements "Asset demand" and "Asset supply") can be taken by domestic investors and by investors from other areas. In addition, ten of twenty containment actions might be initiated from the outside ("Appreciation of domestic currency" [#1.4], "Depreciation of domestic currency" [#1.5], "Asset purchases from markets" [#1.6], "Asset purchases from banks" [#1.7], all actions of the lender of last resort [#2.1, #2.2, and #2.3], "Deposit insurance, guarantees and nationalisation" [#3.1], "Asset purchase programme" [#3.2] and "Asset transfer programme [#3.3].)

The assumed asset category of this model is every investment that creates flexible future cash flows (e.g. dividends of stocks). Out of scope are assets with an agreed cash flow (e.g. bonds). They behave differently if the money supply changes. This model assumes one price of an asset. Potential price differences on different exchanges are arbitraged.

Interdependencies of the asset to other assets are modelled by the elements and interrelations of the asset price theory that is dealt with in Chapter 4.1. This model assumes that banks only provide loans to investors of the asset. Both are different parties. Possible overlaps are not integrated into this model. During this research, discussions were held on whether interest rates should be reduced below zero. Money would have to be paid to deposit money. With regard to financial crisis containment, there is only limited knowledge about it. Therefore, this research relinquishes this aspect.

The fourth chapter described theories about financial crisis, financial markets and financial containment. All information were transferred to elements and interrelations and, in combination, led to the systemic financial crisis model. The next chapter takes this developed model and the chosen analytical methods and analyses the containment actions.

5 Results of the developed complex system analysis

This chapter shows the results of the analysis of the developed complex financial crisis model. The methods are described in Chapter 3.3. The outcomes of the historical evaluation is shown in Chapter 6.

The systemic analysis covers the four aspects of “Sustainability of actions”, “Systemic role of elements”, Impact of actions” and “Interferences of actions”. For each of these analyses the documentation starts with identified actions (see Chapter 4.5). In addition, potential new actions are analysed to provide a complete picture. They are linked to elements that were not analysed by identified actions. They are documented in the second sections of Chapters 5.1, 5.2, 5.3 and 5.4. The sequence of the documentation corresponds to the numbering of the elements. The details of all analyses are listed in the appendices. Chapter 5.4, starting on page 414, summarises the results of Chapters 5.1, 5.2 and 5.3. The interferences of identified actions and promising new actions are outlined in Chapter 5.5.

5.1 Sustainability of actions

This section deals with the sustainability of actions. For each element, the numbers of positive and negative cycles are counted and their lengths analysed. In addition, the involvement of the system’s elements in positive and negative cycles are examined (the details of the method are described in Chapter 3.3.2). All results are interpreted. The first section starts with identified actions and the second sections contains potential new actions. A summary of this analysis is documented on page 166 for identified actions and on page 200 for potential new actions.

5.1.1 Analysis of identified actions

Element 1: Asset demand

Relevance: Action 1-6 "Asset purchases from markets"

Results: The Element "Asset demand" initiates 282 cycles. An increase of the Element "Asset demand" causes 148 positive cycles, which amplify the initial impulse and 134 negative cycles reversing the initial impulse. 5.0% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.2 for positive cycles and 15.7 for negative cycles. The median is 16.0 for both. The spreads of the lengths are similar for positive and negative cycles. Figure 5-1 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

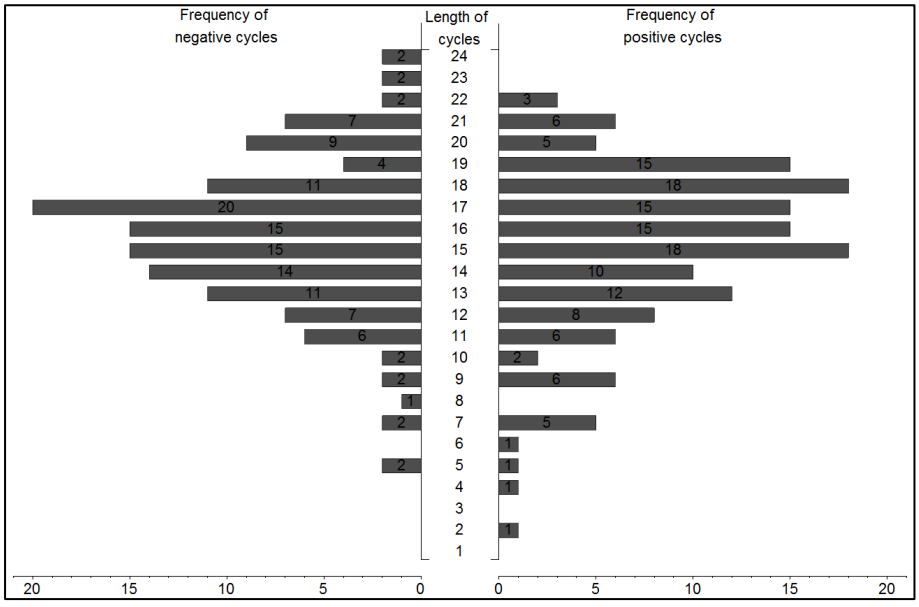


Figure 5-1: Lengths of the cycles of Element 1 ("Asset demand")

The Elements "Asset price" and "Risk of contagion" are directly related and, therefore, more often involved in the cycles of Element 1. Indirectly, the Elements "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles. In general,

elements are equally involved in positive and negative cycles. However, there is one significant exception. The Element "Creditworthiness of banks" is more often involved in positive cycles. Figure 5-2 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

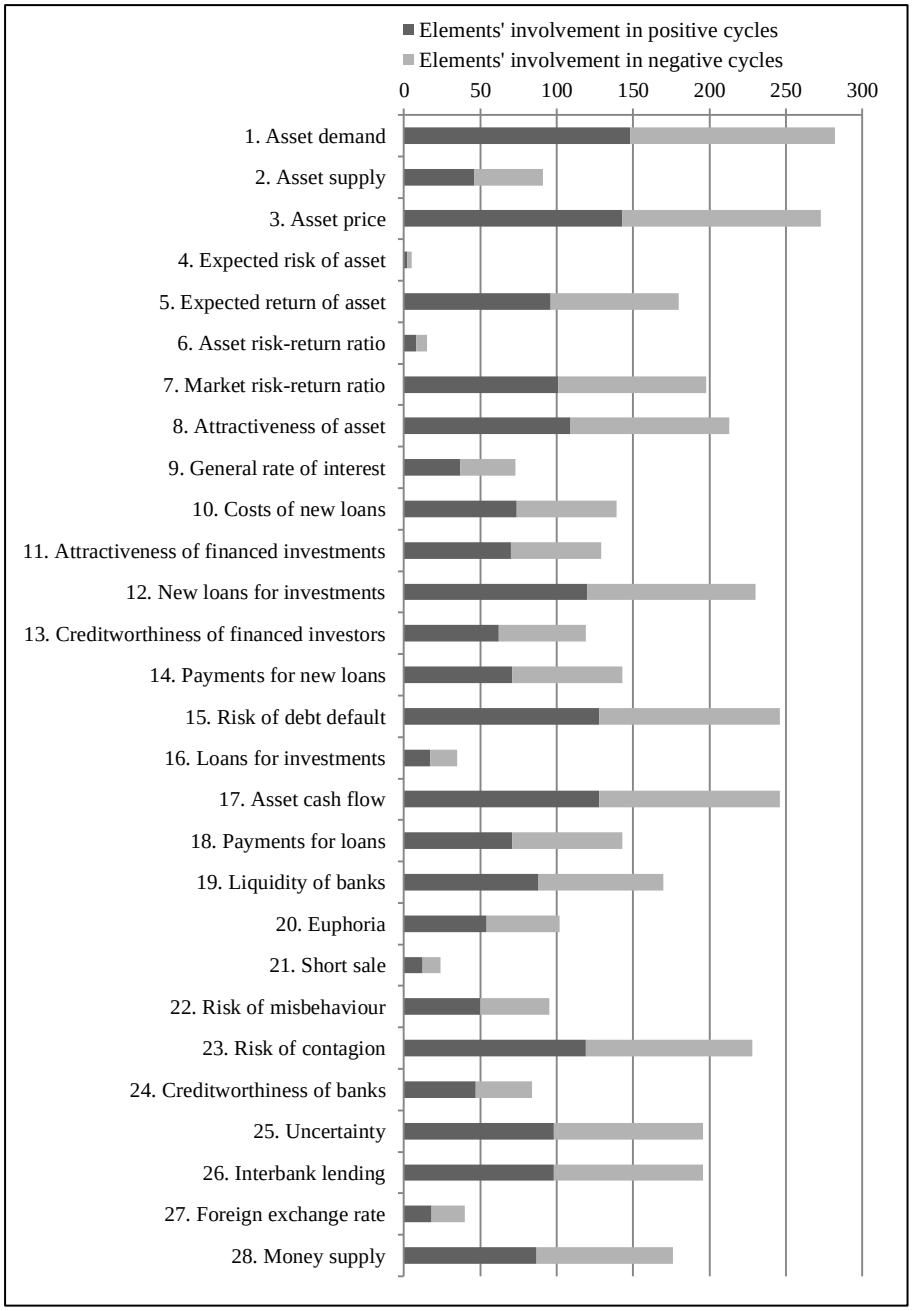


Figure 5-2: Involvement of elements in the cycles of Element 1 ("Asset demand")

Interpretation: The initial impulse of increasing the Element "Asset demand" is sustainable. 134 negative cycles are more than equalised by 148 positive cycles.

Element 3: Asset price

Relevance: Action 3-7 "Bank holidays on exchanges"

Results: The Element "Asset price" initiates 524 cycles. An increase of the Element "Asset price" causes 269 positive cycles, which amplify the initial impulse and 255 negative cycles reversing the initial impulse. 2.7% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.4 for positive cycles and 15.6 for negative cycles. The median is 16.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-3 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

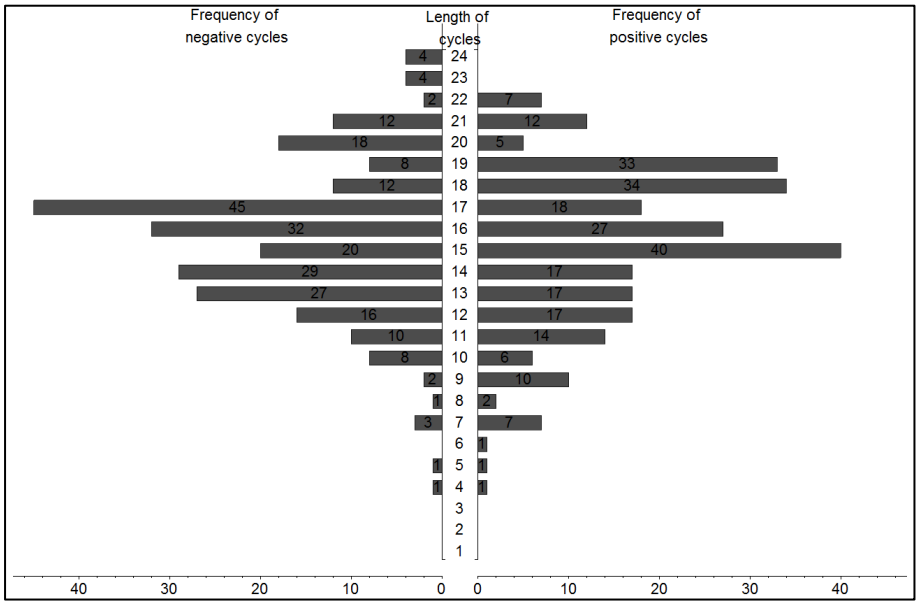


Figure 5-3: Lengths of the cycles of Element 3 ("Asset price")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in the cycles of Element 3.

Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow", "Uncertainty" and "Interbank lending" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-4 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

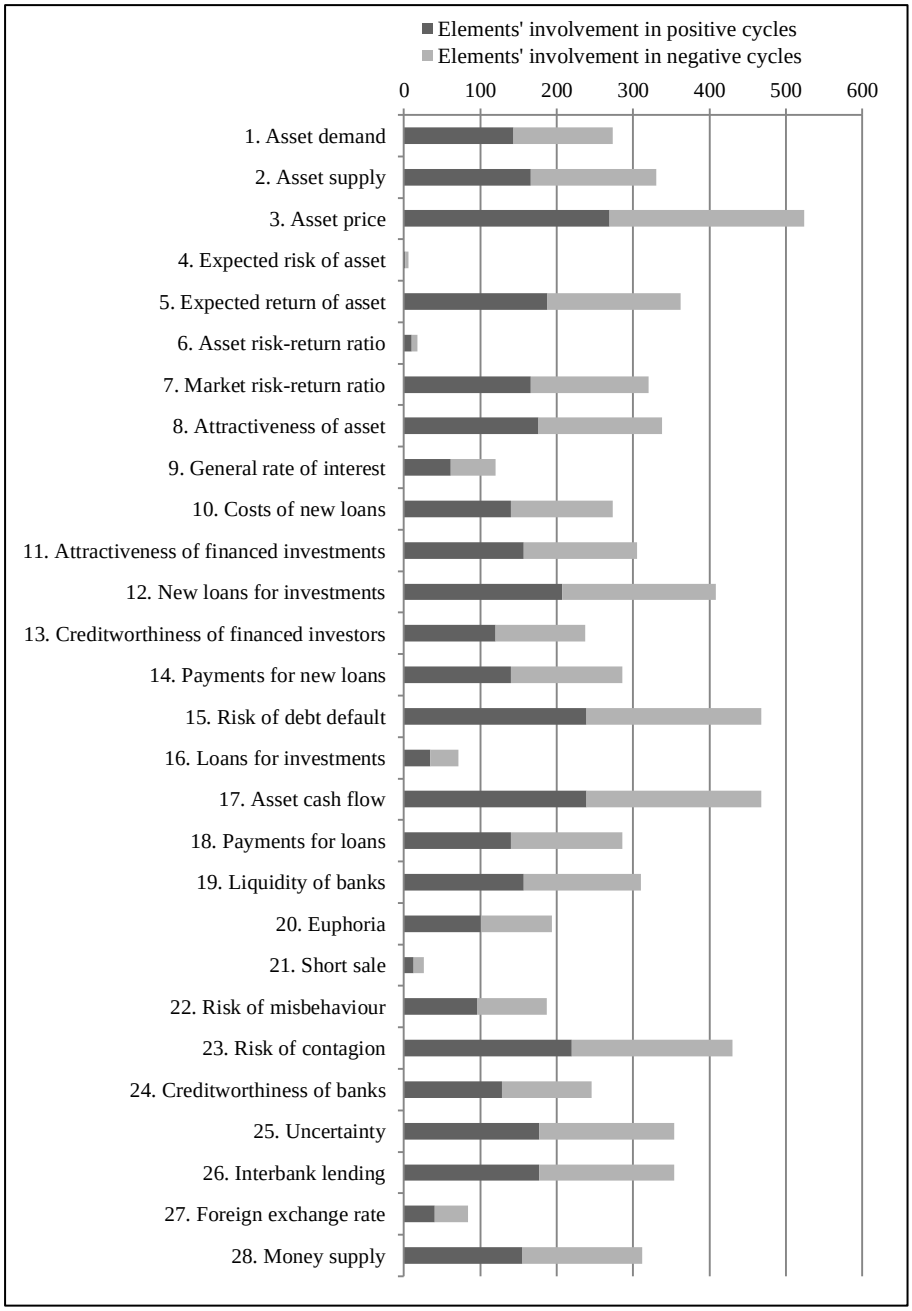


Figure 5-4: Involvement of elements in the cycles of Element 3 ("Asset price")

Interpretation: The initial impulse of fixing the Element "Asset price" prevents further drops. 255 negative cycles are more than equalised by 269 positive cycles. Without an intervention the price would still decrease due to the dominance of 269 amplifying cycles. This action can be seen as slightly sustainable.

Element 9: General rate of interest

Relevance: Action 1-2 "Increasing of general interest rate"

Action 1-3 "Decreasing of general interest rate"

Results: The Element "General rate of interest" initiates 130 cycles. An increase or a decrease cause 66 positive cycles, which amplify the initial impulse and 64 negative cycles reversing the initial impulse. 1.5% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 17.2 for positive cycles and 18.2 for negative cycles. The median is 18.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-5 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

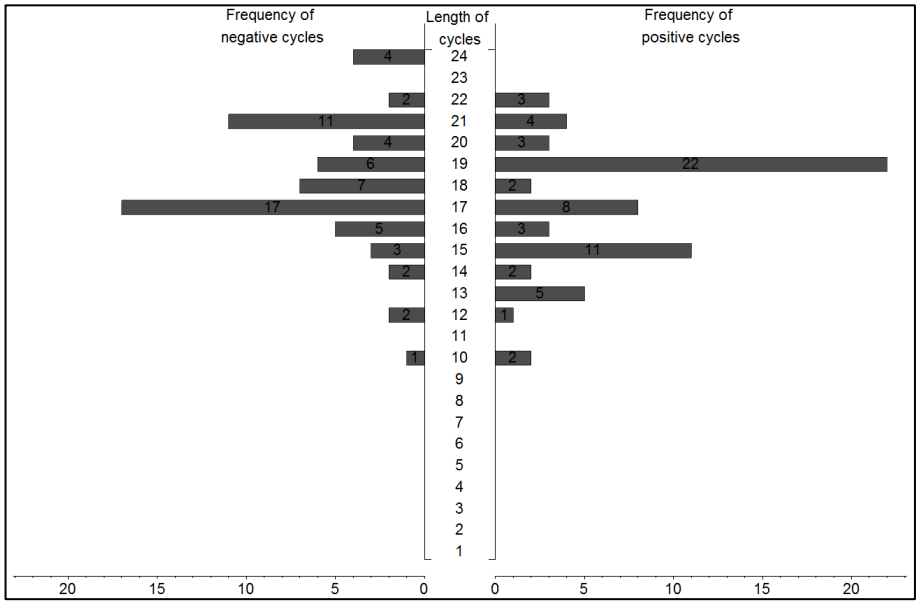


Figure 5-5: Lengths of the cycles of Element 9 ("General rate of interest")

Indirectly, the Elements “Asset price”, “New loans for investments”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles in the cycles of Element 9. In general, elements are equally involved in positive and negative cycles. However, there are several significant exceptions. The Elements “Market risk-return ratio“ and “Attractiveness of asset“ are more often involved in positive cycles. The Elements “New loans for investments“, “Creditworthiness of financed investors“, “Payments for loans” and “Payments for new loans” are more often involved in negative cycles. Figure 5-6 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

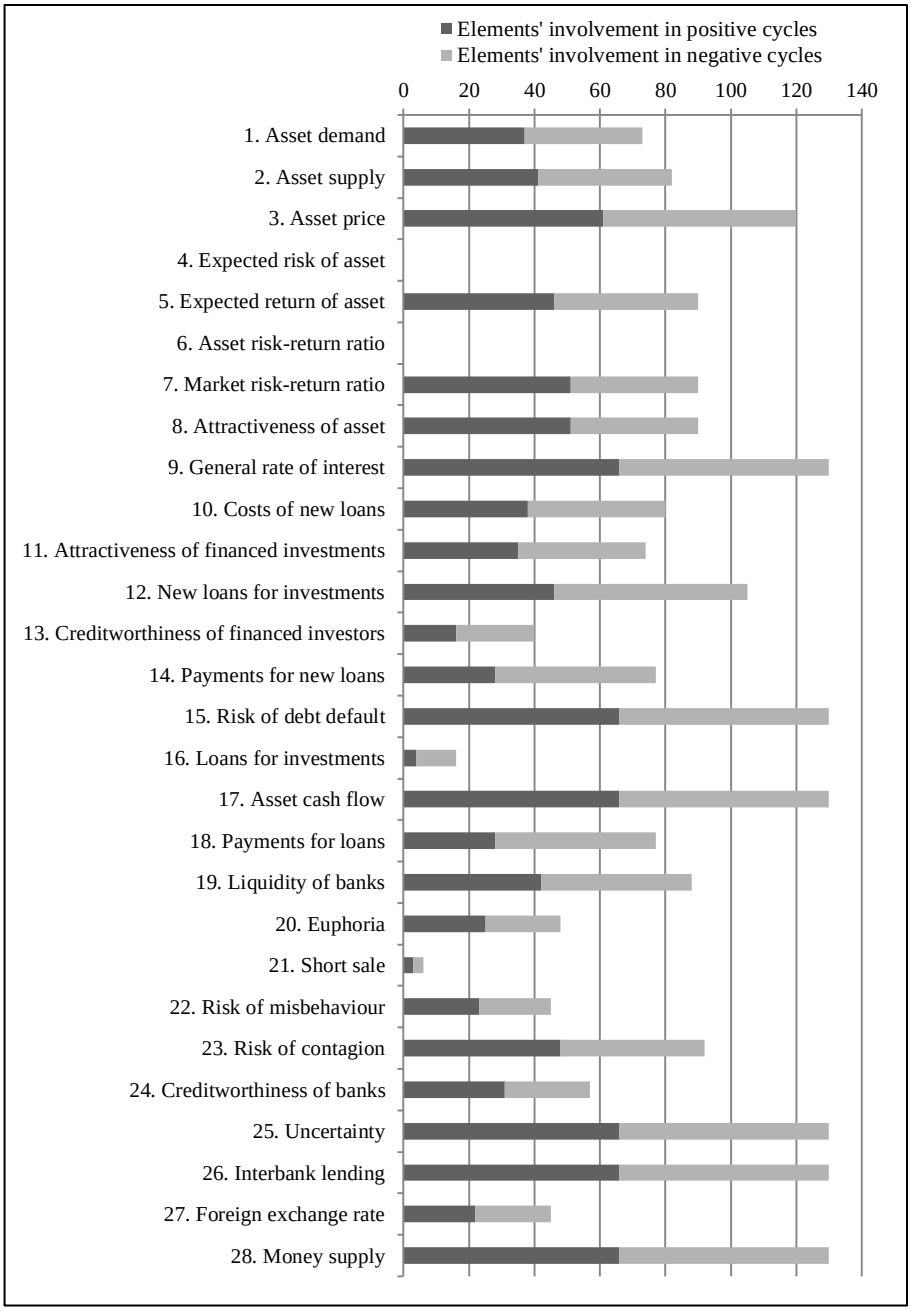


Figure 5-6: Involvement of elements in the cycles of Element 9 ("General rate of interest")

Interpretation: The initial impulses of increasing or decreasing the Element "General rate of interest" are slightly sustainable. 64 negative cycles are more than equalised by 66 positive cycles.

Element 17: Asset cash flow

Relevance: Action 2-2 "Provision of liquidity to financed investors"

Results: The Element "Asset cash flow" initiates 503 cycles. An increase of the Element "Asset cash flow" causes 256 positive cycles, which amplify the initial impulse and 247 negative cycles reversing the initial impulse. 1.8% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.7 for positive cycles and 15.8 for negative cycles. The median is 16.0 for both. The spreads of the lengths are identical for positive and negative cycles. Figure 5-7 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

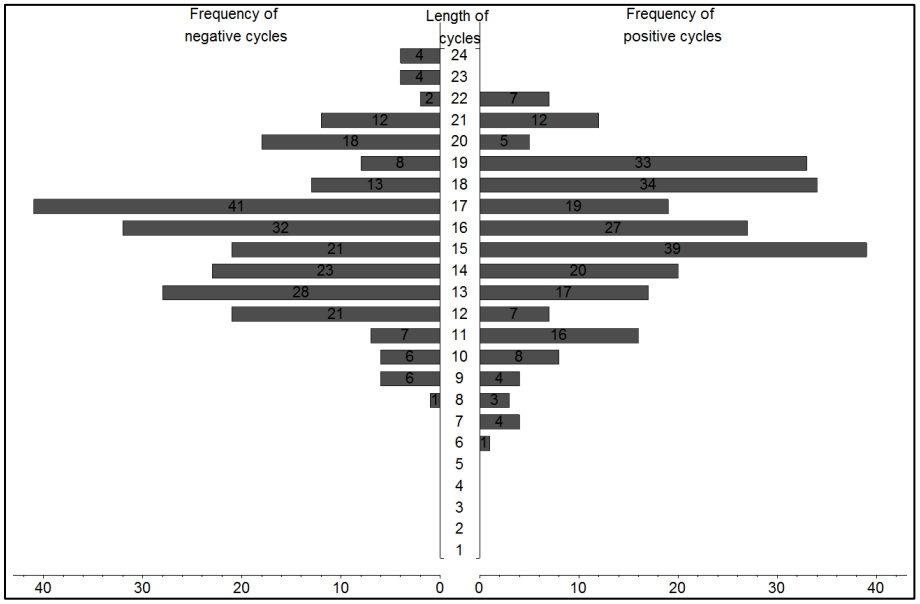


Figure 5-7: Lengths of the cycles of Element 17 ("Asset cash flow")

The Element "Risk of debt default" is directly related and, therefore, more often involved in the cycles of Element 17. Indirectly, the Elements "Asset price", "New loans for investments", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-8 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

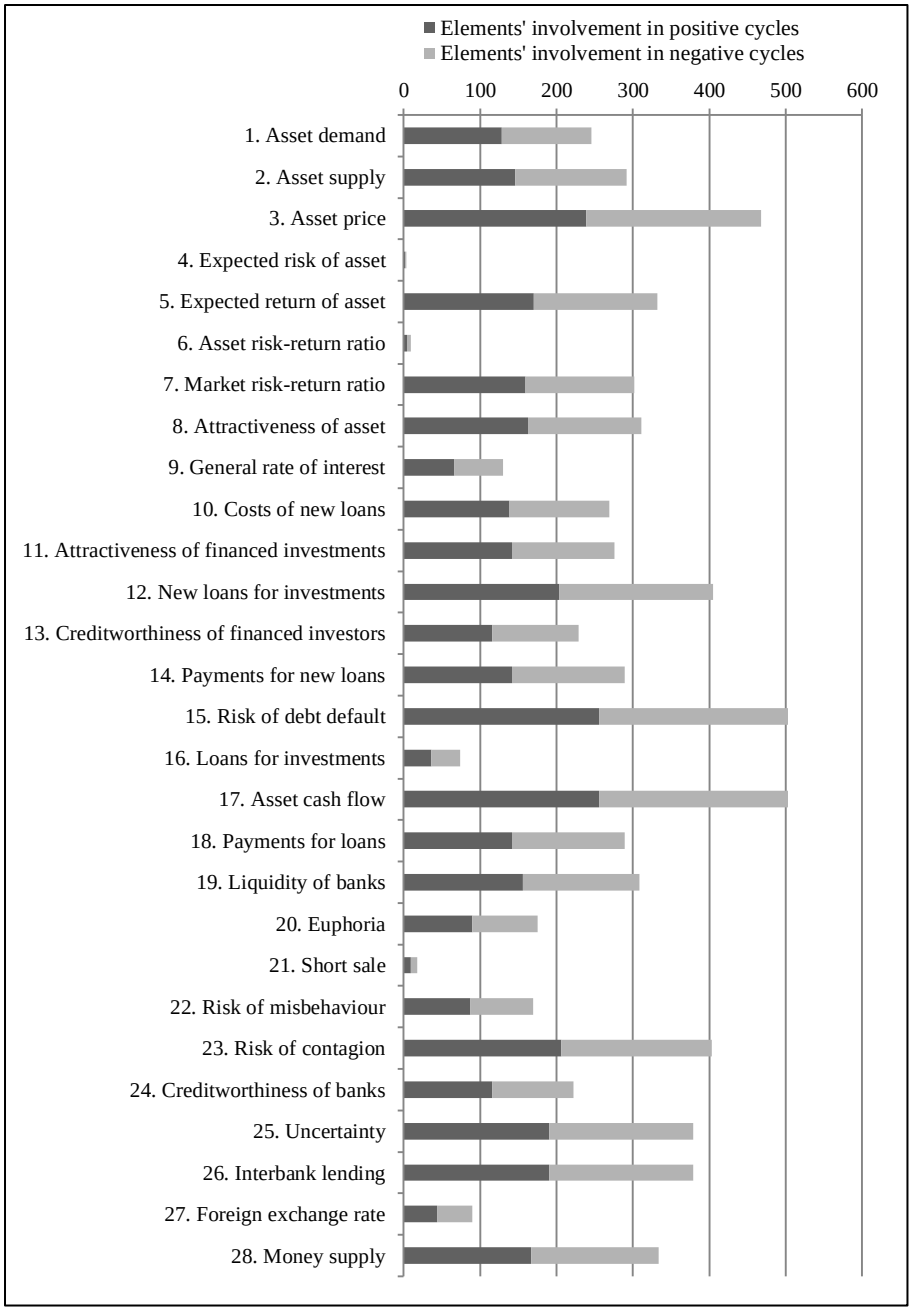


Figure 5-8: Involvement of elements in the cycles of Element 17 ("Asset cash flow")

Interpretation: The initial impulse of increasing the Element "Asset cash flow" is slightly sustainable. 247 negative cycles are more than equalised by 256 positive cycles.

Element 18: Payments for loans

Relevance: Action 3-4 "Debt moratoria for financed investors"

Results: The Element "Payments for loans" initiates 314 cycles. A decrease of the Element "Payments for loans" causes 153 positive cycles, which amplify the initial impulse and 161 negative cycles reversing the initial impulse. 2.5% more negative cycles exist compared to positive cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.7 for positive cycles and 16.6 for negative cycles. The median is 17.0 for both. The spreads of the lengths are similar for positive and negative cycles. Figure 5-9 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

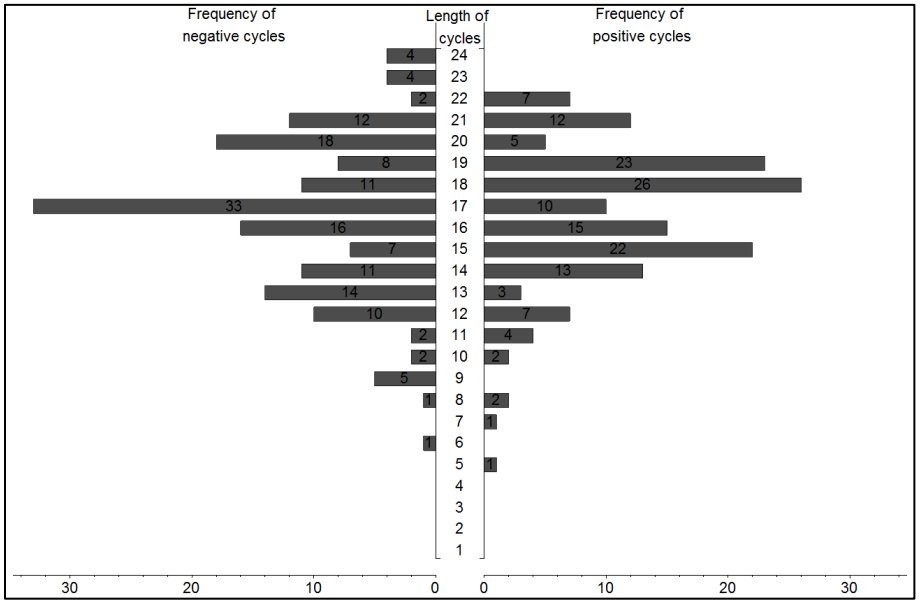


Figure 5-9: Lengths of the cycles of Element 18 ("Payments for loans")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in the cycles of Element 18. Indirectly, the Elements "Asset price", "New loans for investments", "Payments for new loans" and "Risk of debt default" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are two significant exception. The Elements

"General rate of interest" and "Foreign exchange rate" are more often involved in negative cycles. Figure 5-10 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

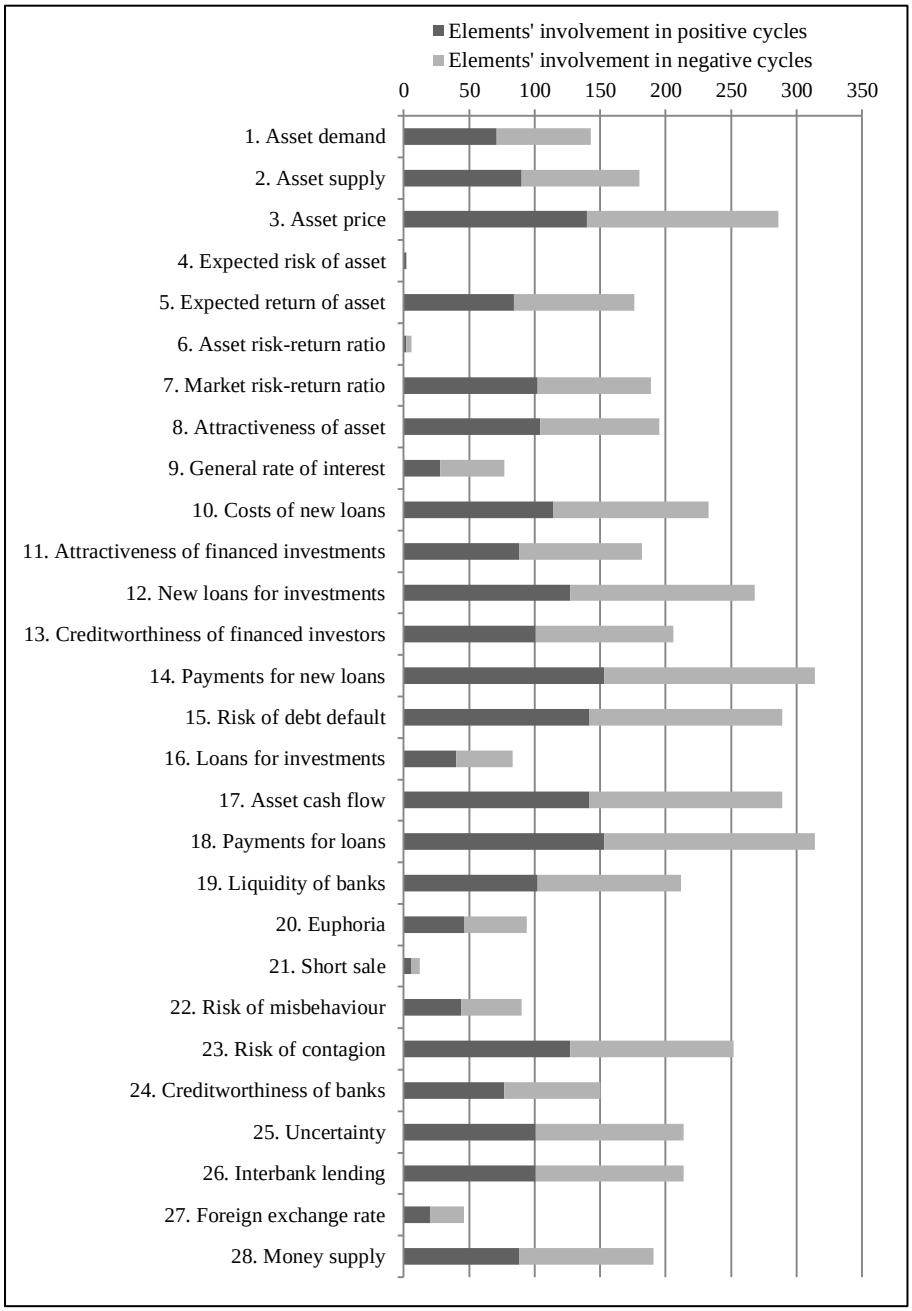


Figure 5-10: Involvement of elements in the cycles of Element 18 ("Payments for loans")

Interpretation: The initial impulse of decreasing the Element "Payments for loans" is unsustainable. 153 positive cycles are equalised by 161 negative cycles.

Element 19: Liquidity of banks

Relevance: Action 1-7 "Asset purchases from banks"
Action 2-1 "Provision of liquidity to banks"
Action 2-3 "Provision of foreign liquidity"
Action 3-2 "Asset purchase programme"
Action 3-6 "Deposit freezing or bank holidays"

Results: The Element "Liquidity of banks" initiates 344 cycles. An increase of the Element "Liquidity of banks" causes 174 positive cycles, which amplify the initial impulse and 170 negative cycles reversing the initial impulse. 1.2% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.0 for positive cycles and 16.1 for negative cycles. The median is 16.5 for positive cycles and 16.0 for negative cycles. The spread of the lengths is higher for negative cycles. Figure 5-11 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

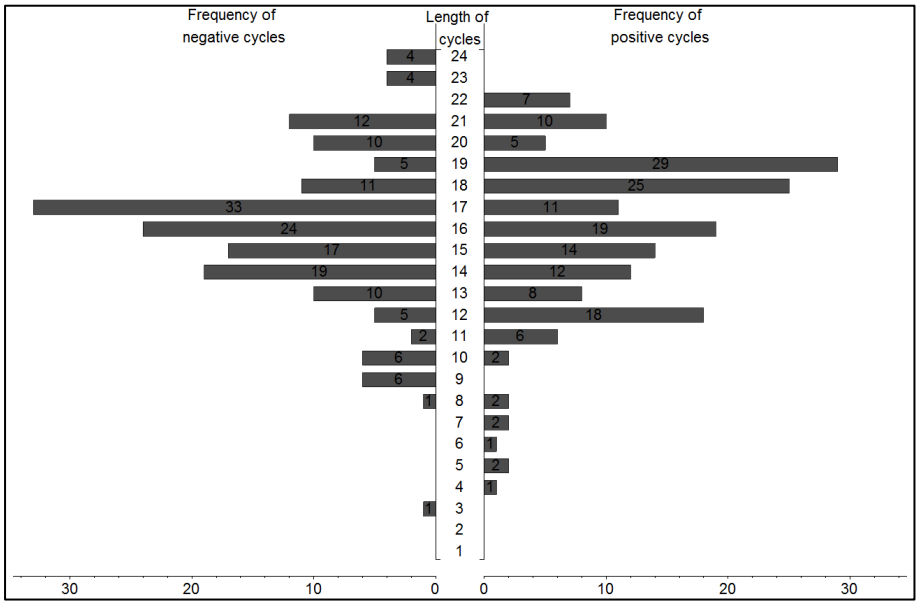


Figure 5-11: Lengths of the cycles of Element 19 ("Liquidity of banks")

Next to other elements, the Element "New loans for investments" is directly related and, therefore, more often involved in the cycles of

Element 19. Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Risk of debt default” and “Risk of contagion” play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are two significant exceptions. The Elements “Market risk-return ratio” and “Attractiveness of asset” are more often involved in positive cycles. Figure 5-12 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

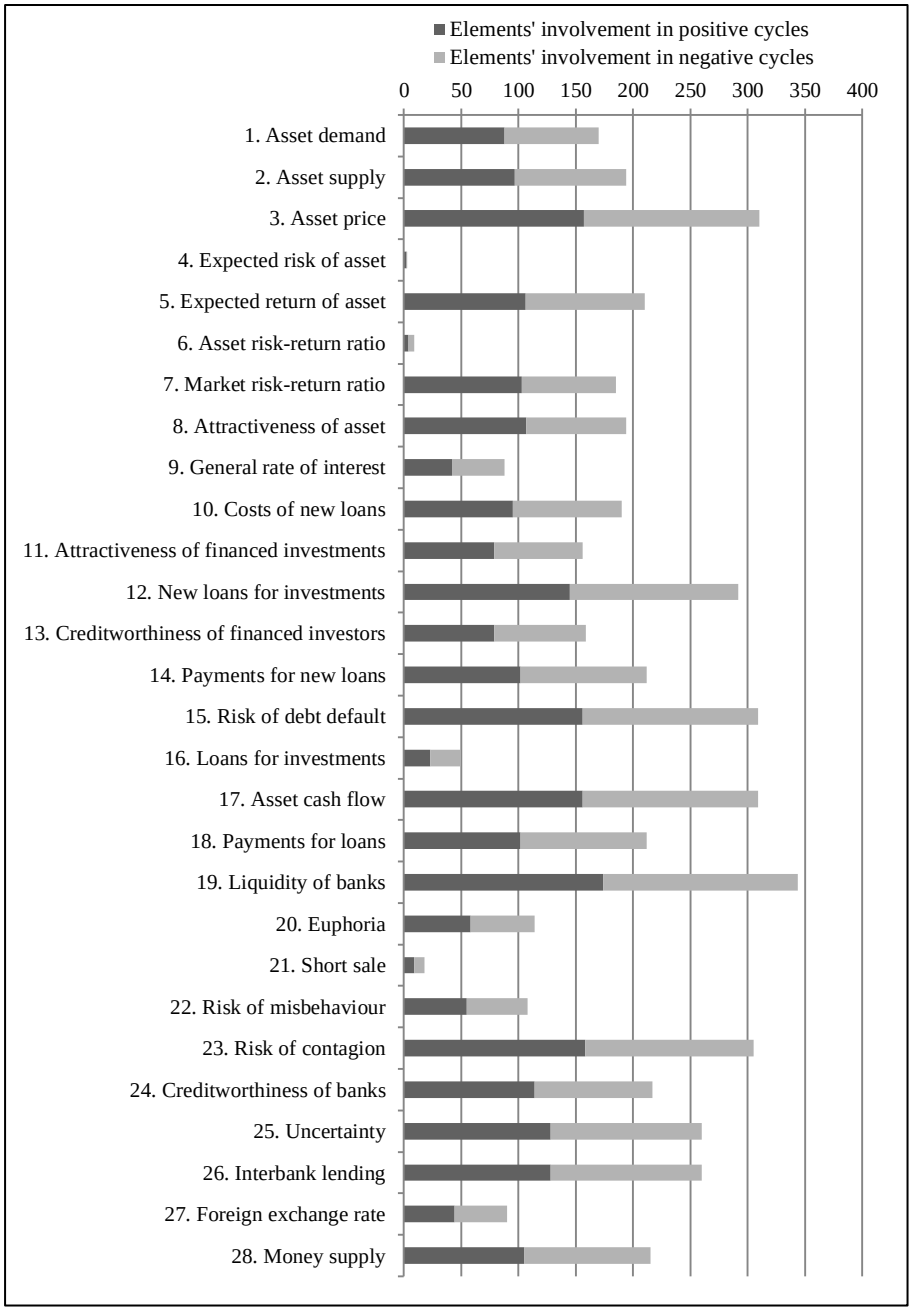


Figure 5-12: Involvement of elements in the cycles of Element 19 ("Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Liquidity of banks" is slightly sustainable. 170 negative cycles are more than equalised by 174 positive cycles.

Element 21: Short sales

Relevance: Action 3-9 "Prohibition of short sales"

Results: The Element "Short sales" initiates 26 cycles. A decrease of the Element "Short sales" causes 13 positive cycles, which amplify the initial impulse and 13 negative cycles reversing the initial impulse. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 13.8 for positive cycles and 13.7 for negative cycles. The median is 16.0 for positive cycles and 15.0 for negative cycles. The spreads of the lengths are almost identical for positive and negative cycles. For a detailed list of numbers please refer to Appendix 2.

Next to other elements, the Element "Asset demand" is directly related and, therefore, more often involved in the cycles of Element 21. Indirectly, the Elements "Asset price" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-13 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

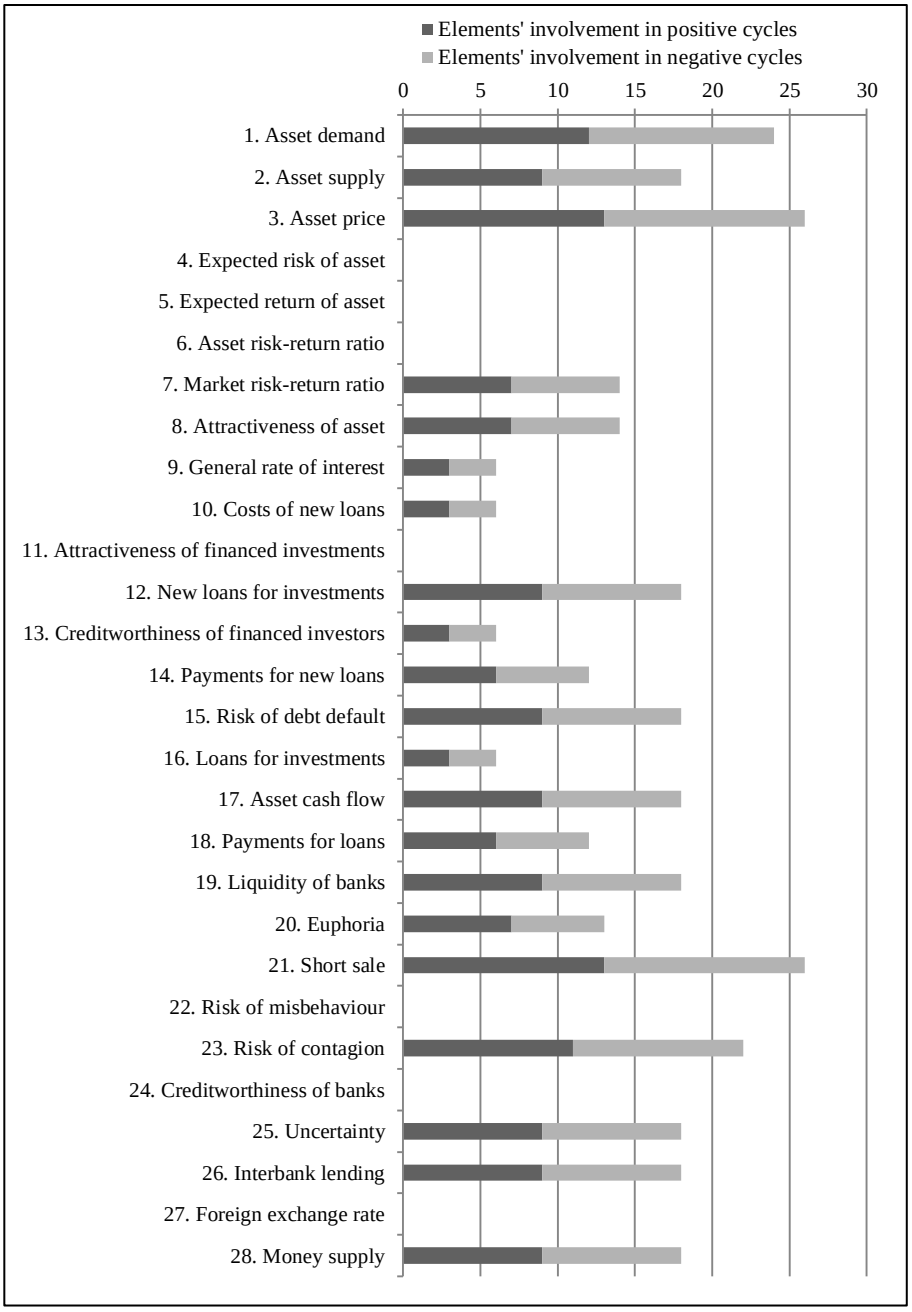


Figure 5-13: Involvement of elements in the cycles of Element 21 ("Short sales")

Interpretation: The initial impulse of decreasing the Element "Short sales" is unsustainable. 13 negative cycles equalise 13 positive cycles.

Element 24: Creditworthiness of banks

Relevance: Action 1-8 "Lightening of collateral requirements"
Action 3-1 "Deposit insurance, guarantees and nationalisation"
Action 3-3 "Asset transfer programme"
Action 3-5 "Accounting discretion"

Results: The Element "Creditworthiness of banks" initiates 250 cycles. An increase of the Element "Creditworthiness of banks" causes 130 positive cycles, which amplify the initial impulse and 120 negative cycles reversing the initial impulse. 4.0% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.6 for positive cycles and 16.5 for negative cycles. The median is 18.0 for positive cycles and 16.0 for negative cycles. The spread of the lengths is higher for positive cycles. Figure 5-14 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

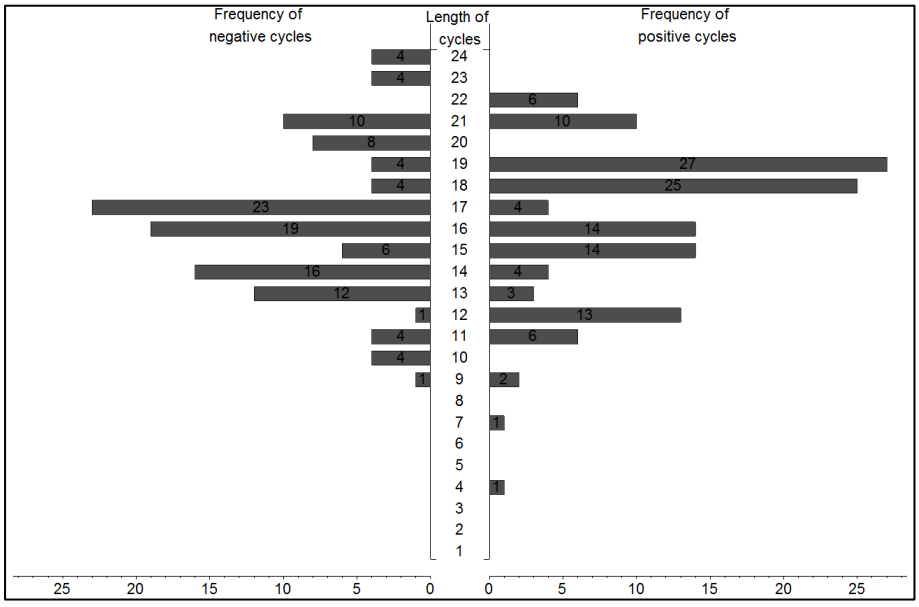


Figure 5-14: Lengths of the cycles of Element 24 ("Creditworthiness of banks")

The Element "Risk of contagion" is directly related and, therefore, more often involved in the cycles of Element 24. Indirectly, the Elements

"Asset price", "Risk of debt default", "Asset cash flow" and "Liquidity of banks" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there is one significant exception. The Element "Asset demand" is more often involved in positive cycles. Figure 5-15 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

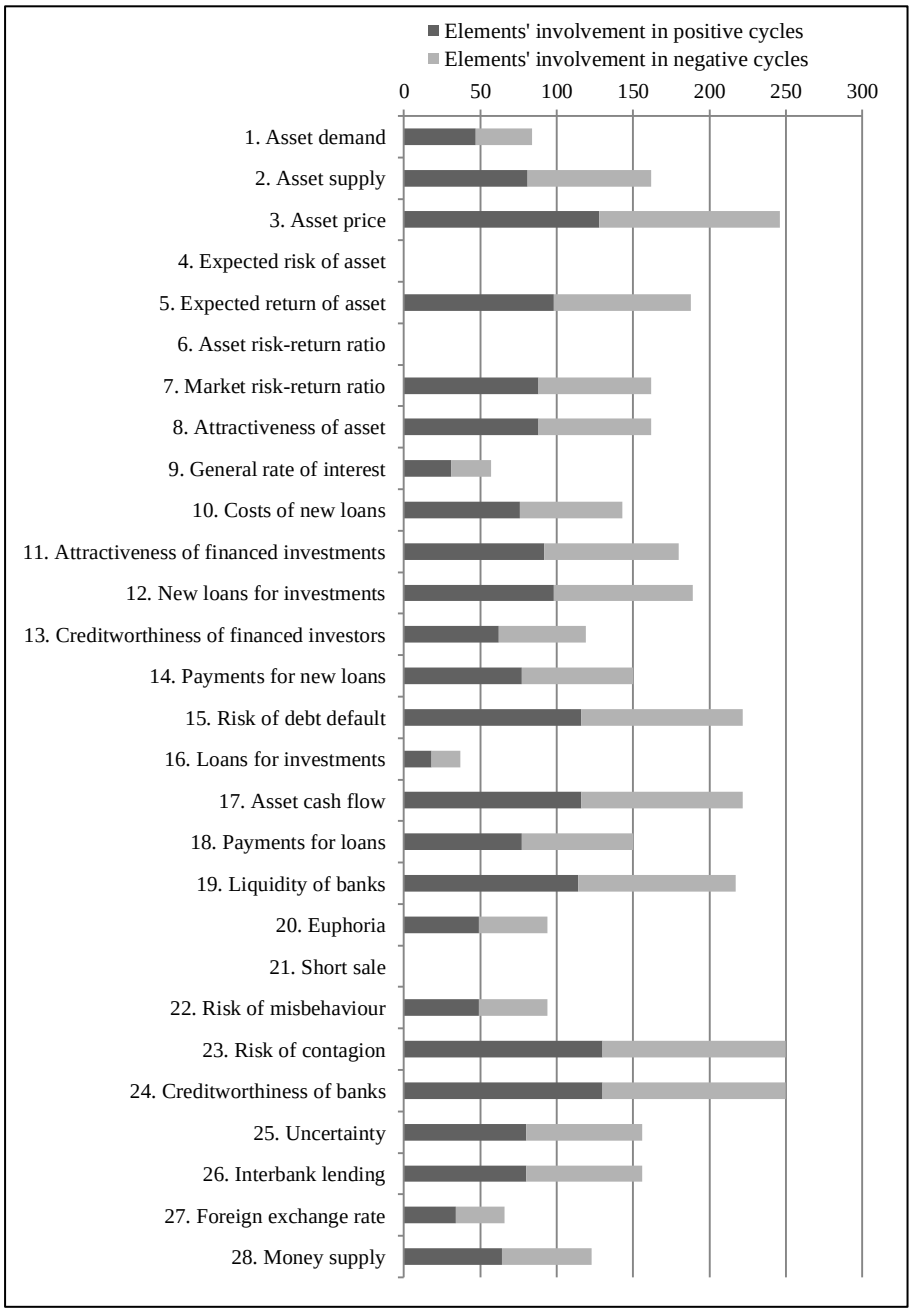


Figure 5-15: Involvement of elements in the cycles of Element 24 ("Creditworthiness of banks")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of banks" is slightly sustainable. 120 negative cycles are more than equalised by 130 positive cycles.

Element 25: Uncertainty

Relevance: Action 3-8 "Stress tests"

Results: The Element "Uncertainty" initiates 379 cycles. A decrease of the Element "Uncertainty" causes 190 positive cycles, which amplify the initial impulse and 189 negative cycles reversing the initial impulse. 0.3% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.4 for positive cycles and 16.6 for negative cycles. The median is 17.0 for both. The spreads of the lengths are identical for positive and negative cycles. Figure 5-16 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

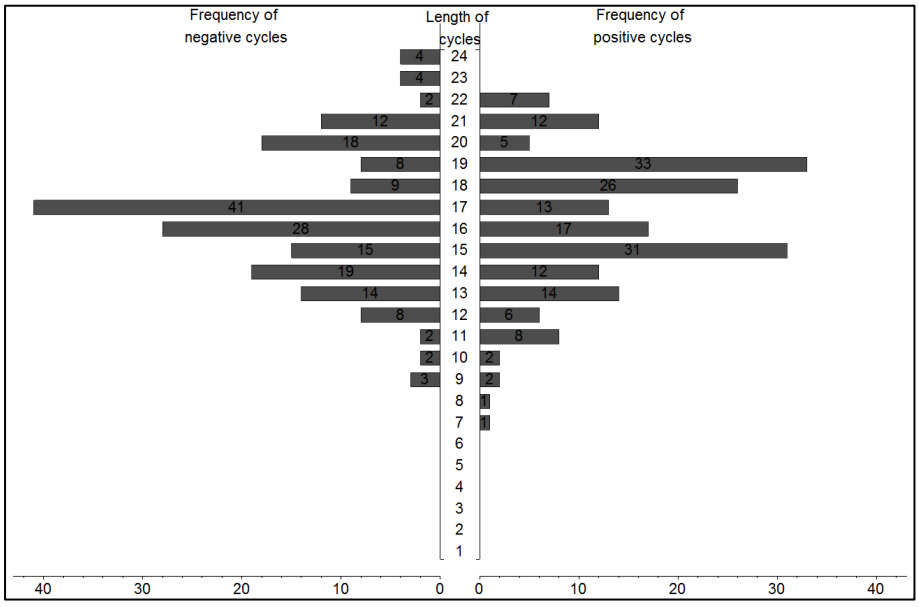


Figure 5-16: Lengths of the cycles of Element 25 ("Uncertainty")

The Element "Interbank lending" is directly related and, therefore, more often involved in the cycles of Element 25. Indirectly, the Elements

"Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow" and "Money supply" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-17 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

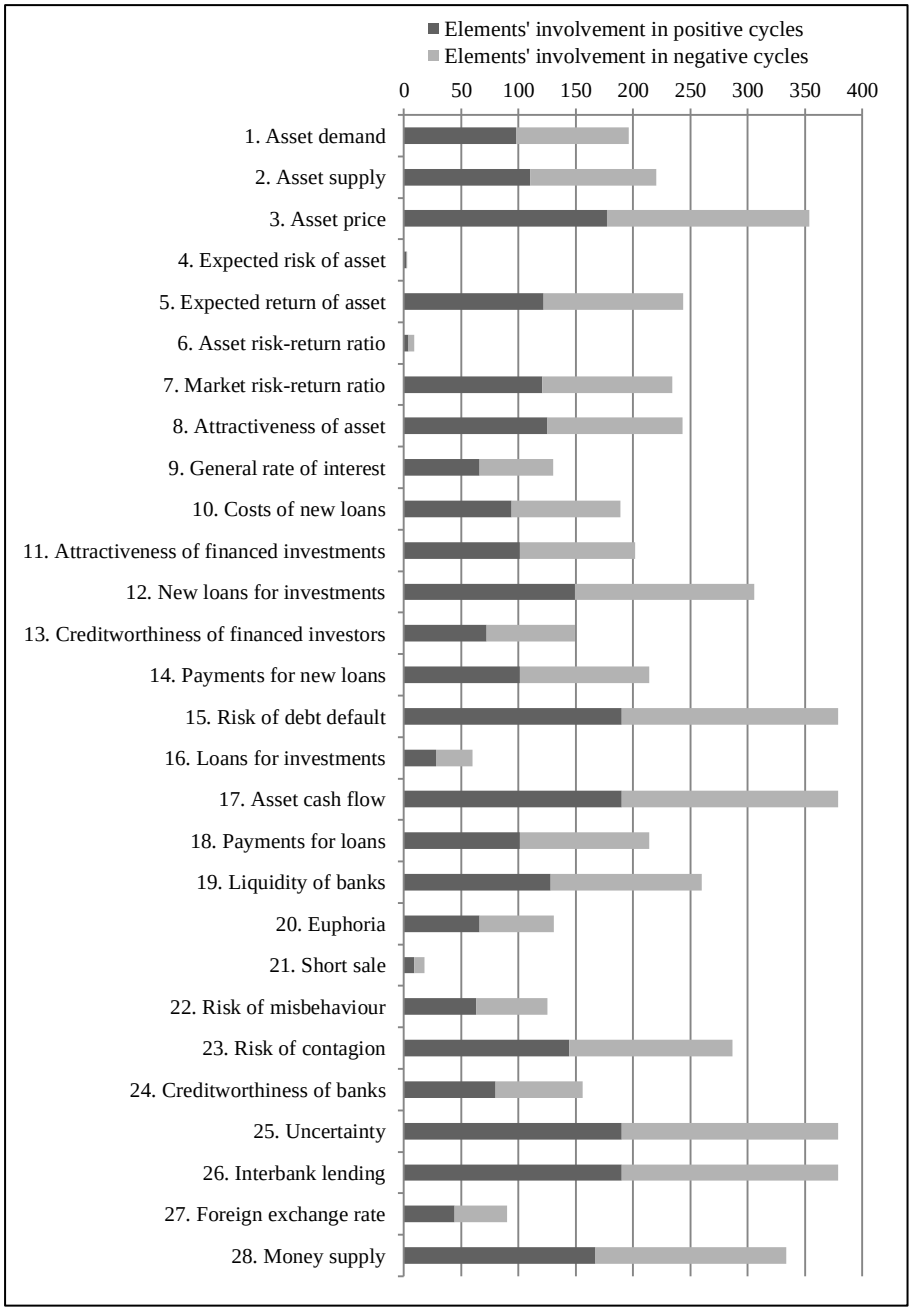


Figure 5-17: Involvement of elements in the cycles of Element 25 ("Uncertainty")

Interpretation: The initial impulse of decreasing the Element "Uncertainty" is slightly sustainable. 189 negative cycles are more than equalised by 190 positive cycles.

Element 27: Foreign exchange rate

Relevance: Action 1-4 "Appreciation of domestic currency"

Action 1-5 "Depreciation of domestic currency"

Results: The Element "Foreign exchange rate" initiates 90 cycles. An increase or a decrease of the Element "Foreign exchange rate" cause 44 positive cycles, which amplify the initial impulse and 46 negative cycles reversing the initial impulse. 2.2% more negative cycles exist compared to positive cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. Shorter negative cycles are equalised by longer negative cycles. The mean is 17.9 for positive and negative cycles. The median is 18.0 for positive cycles and 17.0 for negative cycles. The spread of the lengths is higher for negative cycles. Figure 5-18 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

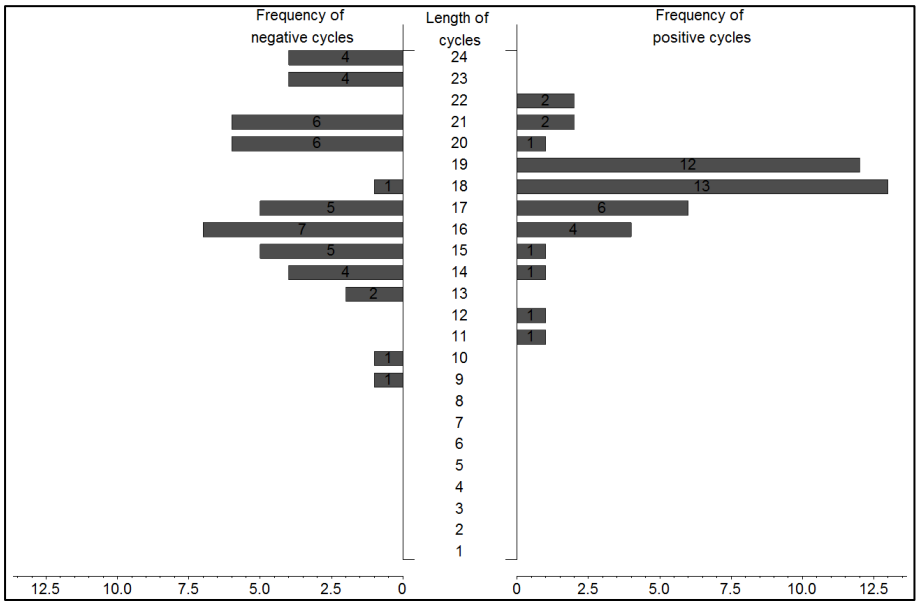


Figure 5-18: Lengths of the cycles of Element 27 ("Foreign exchange rate")

The Element “Liquidity of banks” is directly related and, therefore, more often involved in the cycles of Element 27. Indirectly, the Elements “Asset price”, “New loans for investments”, “Risk of debt default”, “Asset cash flow”, “Risk of contagion”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are several significant exceptions. The Elements “Market risk-return ratio“ and “Attractiveness of asset” are more often involved in positive cycles. The Elements “New loans for investments“, “Payments for loans” and “Payments for new loans” are more often involved in negative cycles. Figure 5-19 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

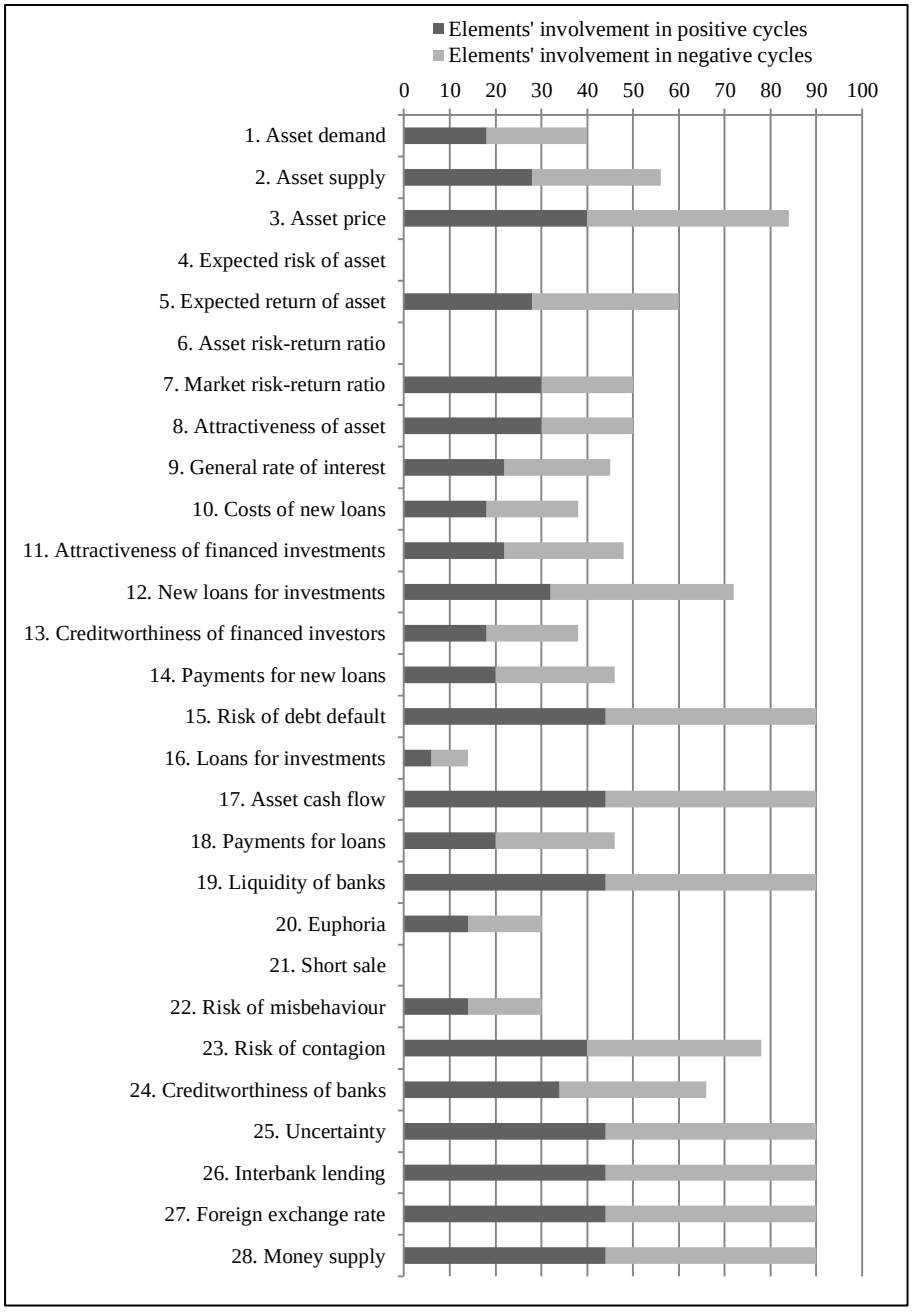


Figure 5-19: Involvement of elements in the cycles of Element 27 ("Foreign exchange rate")

Interpretation: An initial impulses of increasing or decreasing the Element "Foreign exchange rate" are unsustainable. 46 negative cycles are not equalised by 44 positive cycles.

Element 28: Money supply

Relevance: Action 1-1 "Extension of money supply"

Results: The Element "Money supply" initiates 334 cycles. An increase of the Element "Money supply" causes 167 positive cycles, which amplify the initial impulse and 167 negative cycles reversing the initial impulse. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.6 for positive cycles and 16.8 for negative cycles. The median is 17.0 for both. The spreads of the lengths are almost identical for positive and negative cycles. Figure 5-20 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

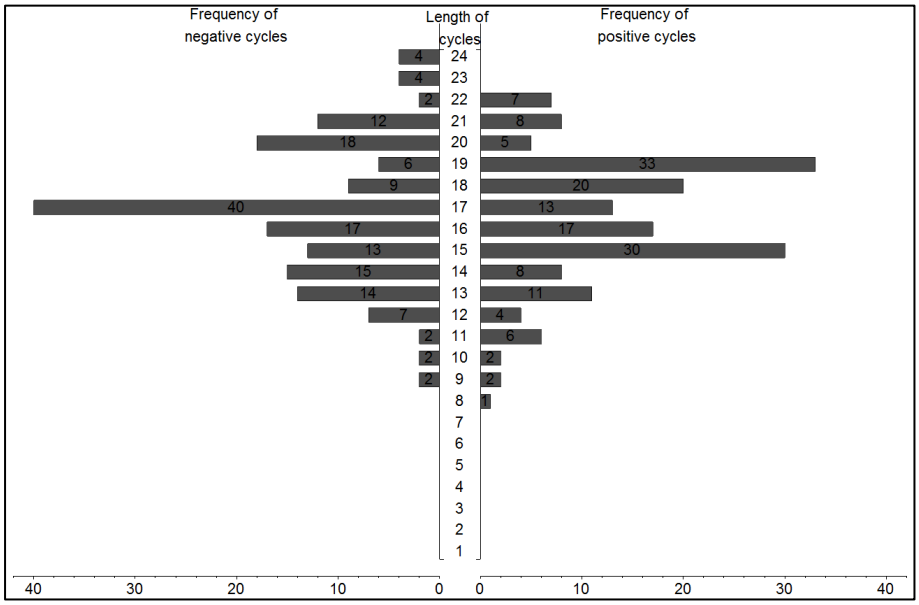


Figure 5-20: Lengths of the cycles of Element 28 ("Money supply")

Next to other elements, the Element "Asset price" is directly related and, therefore, more often involved in the cycles of Element 28. Indirectly, the Elements "Risk of debt default", "Asset cash flow", "Uncertainty" and "Interbank lending" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-21 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

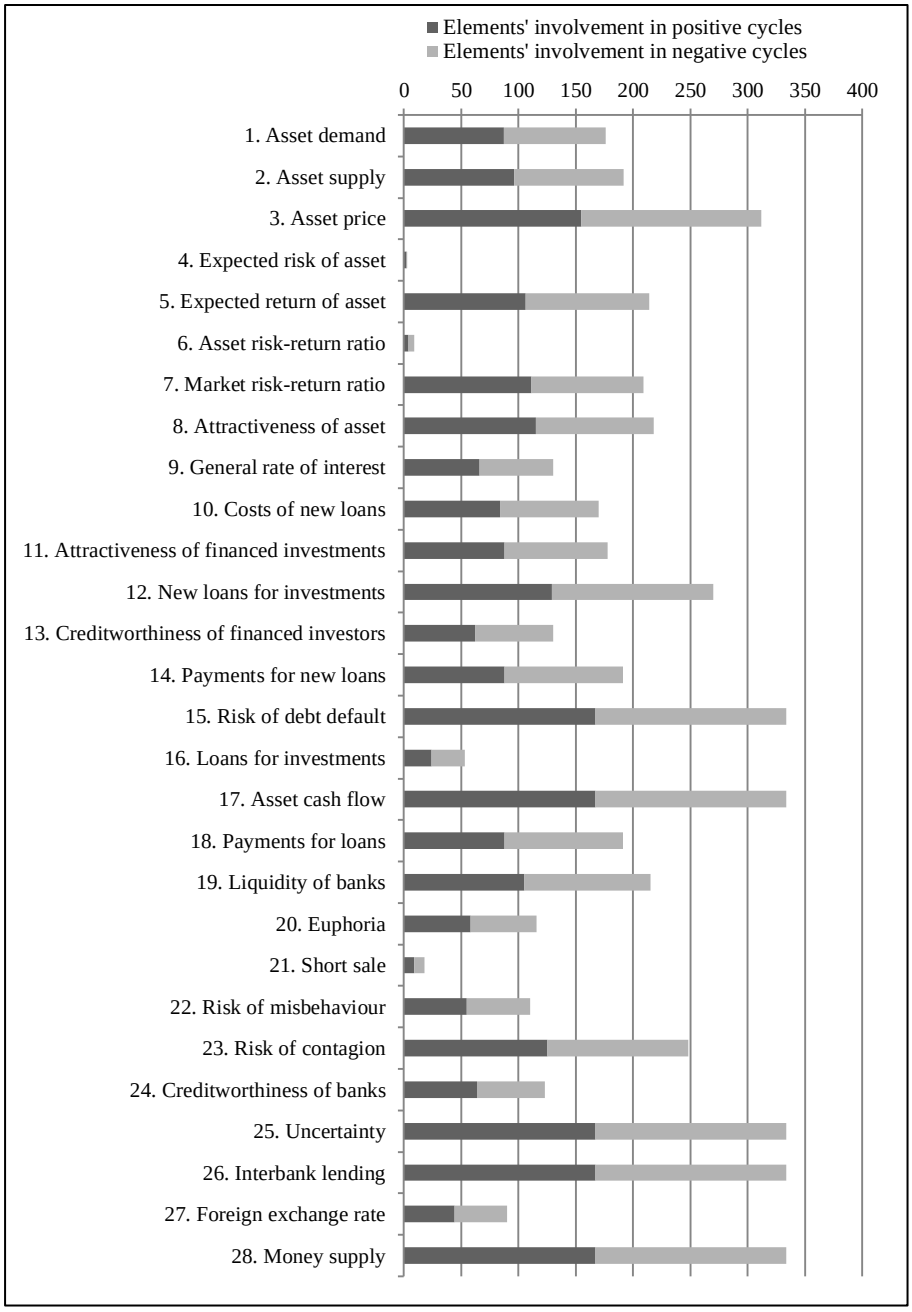


Figure 5-21: Involvement of elements in the cycles of Element 28 ("Money supply")

Interpretation: The initial impulse of increasing the Element "Money supply" is unsustainable. 167 positive cycles are equalised by 167 negative cycles.

Summary of results

This research uses the term "sustainability" as a characteristic of actions. An action can be seen as sustainable if an intended effect of an action is repeated without the initiation of new actions. The sustainability of actions can be measured by identifying long-term consequences of an initial impulse. Cycles are counted and analysed (see Chapter 3.3.2).

The results of the analyses of identified actions are summarised in Table 5-1. The table shows the linked element of each identified action and the classification as sustainable, slightly sustainable or unsustainable, including the overall number of cycles, the number of positive cycles and the number of negative cycles.

Only the action "Asset purchases from markets" [#1-6] can be seen as sustainable. The majority of actions are categorised as slightly sustainable. The actions "Extension of money supply" [#1-1], "Appreciation of domestic currency" [#1-4], "Depreciation of domestic currency" [#1-5], "Debt moratoria for financed investors" [#3-4] and "Prohibition of short sales" [#3-9] are unsustainable.

Table 5-1: Summary of sustainability for identified actions

#	Action	Element	Sustainable	Slightly sustainable	Un-sustainable
1-1	Extension of money supply	28: Money supply	No	No	Yes 324-167-167
1-2	Increasing of general interest rate	9: General rate of interest	No	Yes 130-66-64	No
1-3	Decreasing of general interest rate	9: General rate of interest	No	Yes 130-66-64	No
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No	No	Yes 90-44-46
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No	No	Yes 90-44-46
1-6	Asset purchases from markets	1: Asset demand	Yes 282-148-134	No	No
1-7	Asset purchases from banks	19: Liquidity of banks	No	Yes 344-174-170	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No	Yes 250-130-120	No
2-1	Provision of liquidity to banks	19: Liquidity of banks	No	Yes 344-174-170	No
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No	Yes 503-256-247	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No	Yes 344-174-170	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	No	Yes 250-130-120	No
3-2	Asset purchase programme	19: Liquidity of banks	No	Yes 344-174-170	No
3-3	Asset transfer programme	24: Creditworthiness of banks	No	Yes 250-130-120	No
3-4	Debt moratoria for financed investors	18: Payments for loans	No	No	Yes 314-153-161
3-5	Accounting discretion	24: Creditworthiness of banks	No	Yes 250-130-120	No
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Yes 344-174-170	No
3-7	Bank holidays on exchanges	3: Asset price	No	Yes 524-269-255	No
3-8	Stress tests	25: Uncertainty	No	Yes 379-190-189	No
3-9	Prohibition of short sales	21: Short sales	No	No	Yes 26-13-13

This section showed the results of the sustainability analysis for identified actions. The next pages deal with analysis of potential new actions.

5.1.2 Analysis of potential new actions

Element 2: Asset supply

Results: The Element "Asset supply" initiates 331 cycles. An increase or a decrease of the Element "Asset supply" cause 167 positive cycles, which amplify the initial impulse and 164 negative cycles reversing the initial impulse. 0.9% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.5 for positive cycles and 15.6 for negative cycles. The median is 16.0 for both. The spreads of the lengths are identical for positive and negative cycles. Figure 5-22 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

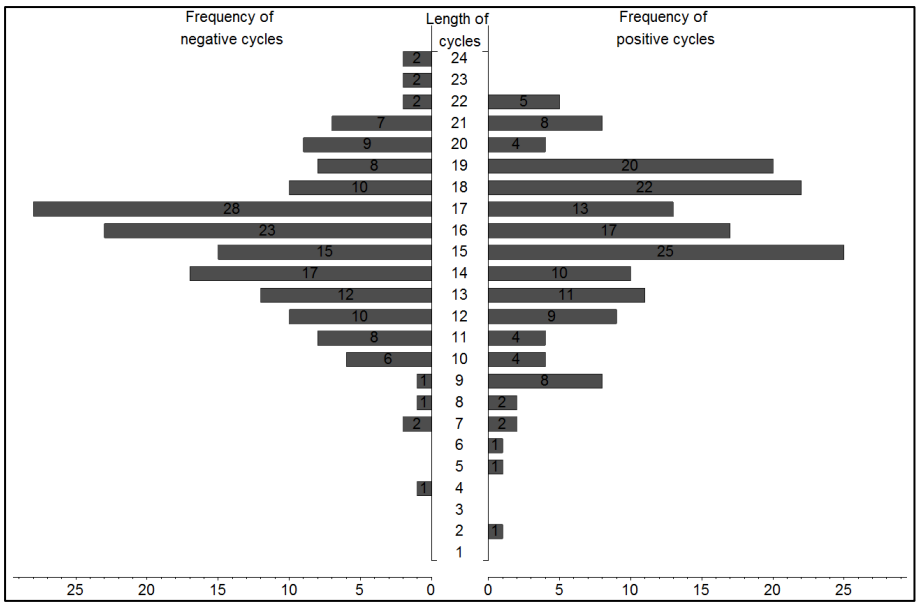


Figure 5-22: Lengths of the cycles of Element 2 ("Asset supply")

The Element "Asset price" is directly related and, therefore, more often involved in the cycles of Element 2. Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-23 shows the respective

distribution. For a detailed list of numbers please refer to Appendix 3.

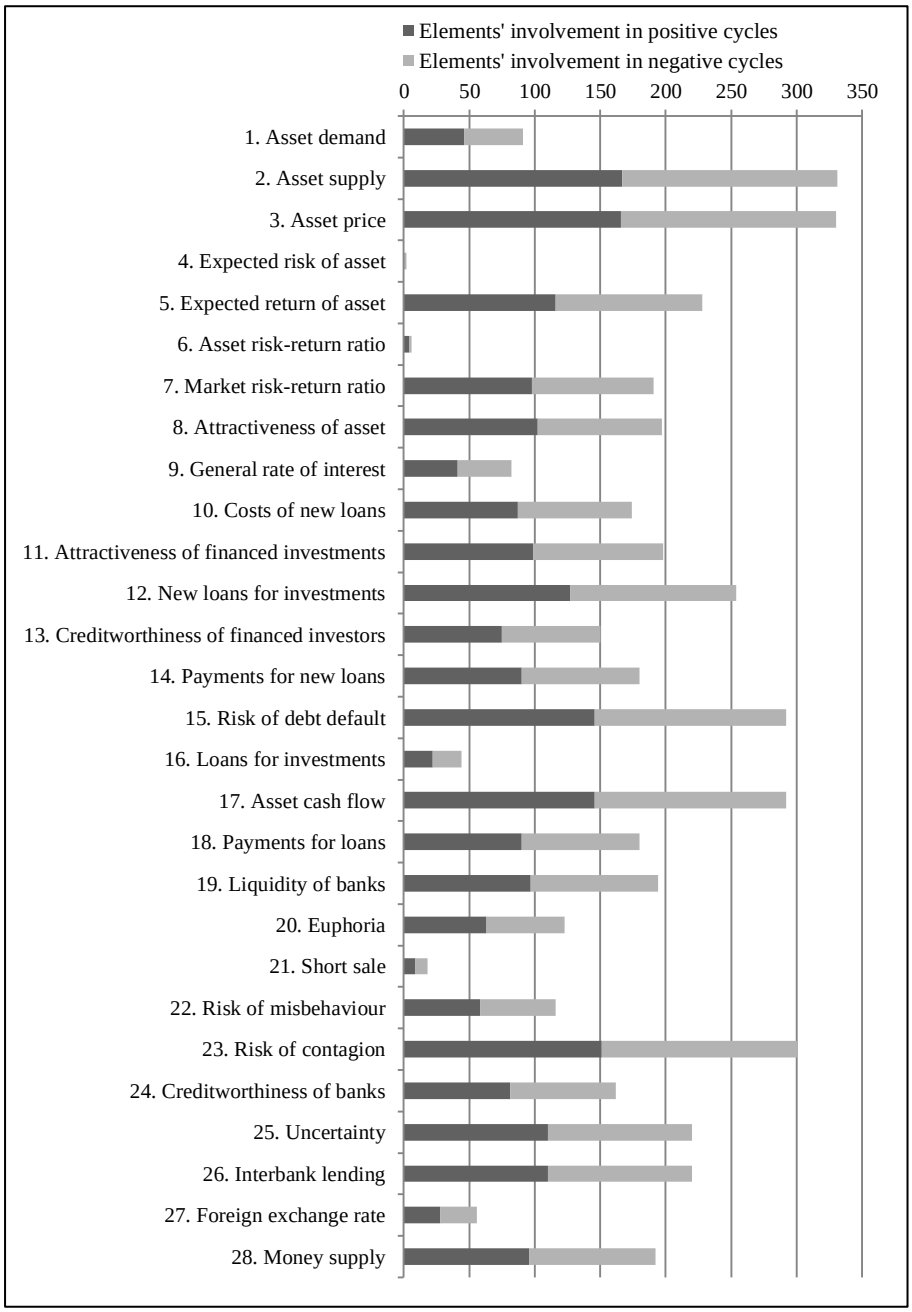


Figure 5-23: Involvement of elements in the cycles of Element 2 ("Asset supply")

Interpretation: The initial impulses of increasing or decreasing the Element "Asset supply" are slightly sustainable. 164 negative cycles are more than equalised by 167 positive cycles.

Element 4: Expected risk of asset

Results: The Element "Expected risk of asset" initiates 6 cycles. An increase or a decrease of the Element "Expected risk of asset" cause 2 positive cycles, which amplify the initial impulse and 4 negative cycles reversing the initial impulse. 33.3% more negative cycles exist compared to positive cycles. For a detailed list of cycles please refer to Appendix 1.

Positive cycles are longer than negative cycles. The mean is 18.5 for positive cycles and 9.5 for negative cycles. The median is 18.5 for positive cycles and 8.0 for negative cycles. For a detailed list of numbers please refer to Appendix 2.

The Element "Asset risk-return ratio" is directly related and, therefore, more often involved in the cycles of Element 4. Indirectly, the Elements "Asset demand", "Asset price", "Expected risk of asset", "Attractiveness of asset" and "Risk of misbehaviour" play significant roles. For a detailed list of numbers please refer to Appendix 3.

Interpretation: The initial impulses of increasing or decreasing the Element "Expected risk of asset" are unsustainable. 2 positive cycles are more than equalised by 4 negative cycles. This affect is amplified by shorter negative cycles.

Element 5: Expected return of asset

Results: The Element "Expected return of asset" initiates 362 cycles. An increase or a decrease of the Element "Expected return of asset" cause 188 positive cycles, which amplify the initial impulse and 174 negative cycles reversing the initial impulse. 3.9% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.5 for positive cycles and 16.0 for negative cycles. The median is 16.0 for both. The spreads of the lengths are identical for positive and negative cycles. Figure 5-24 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

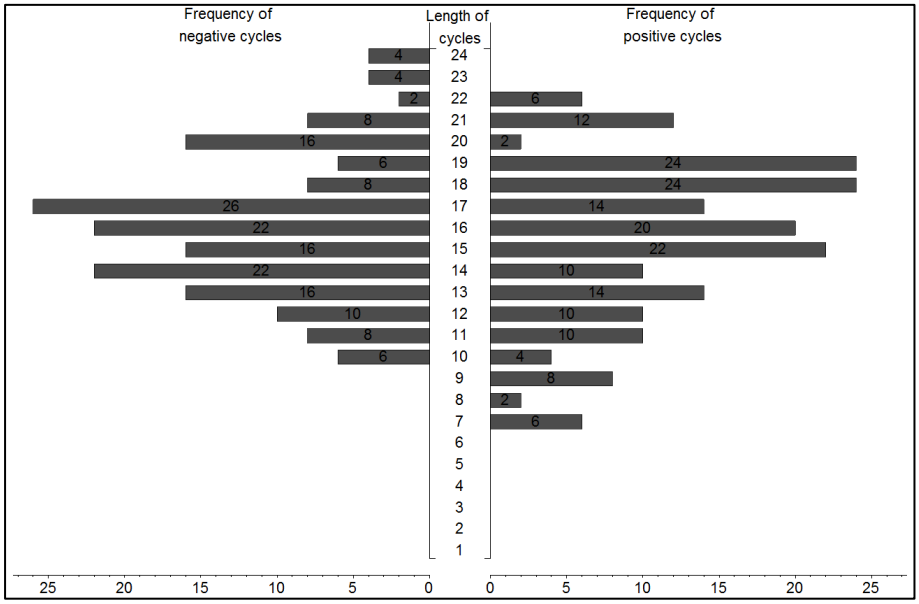


Figure 5-24: Lengths of the cycles of Element 5 ("Expected return of asset")

Next to other elements, the Elements "Asset risk-return ratio" and "Asset cash flow" are directly related and, therefore, more often involved in the cycles of Element 5. Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-25 shows the respective distribution. For a detailed list

of numbers please refer to Appendix 3.

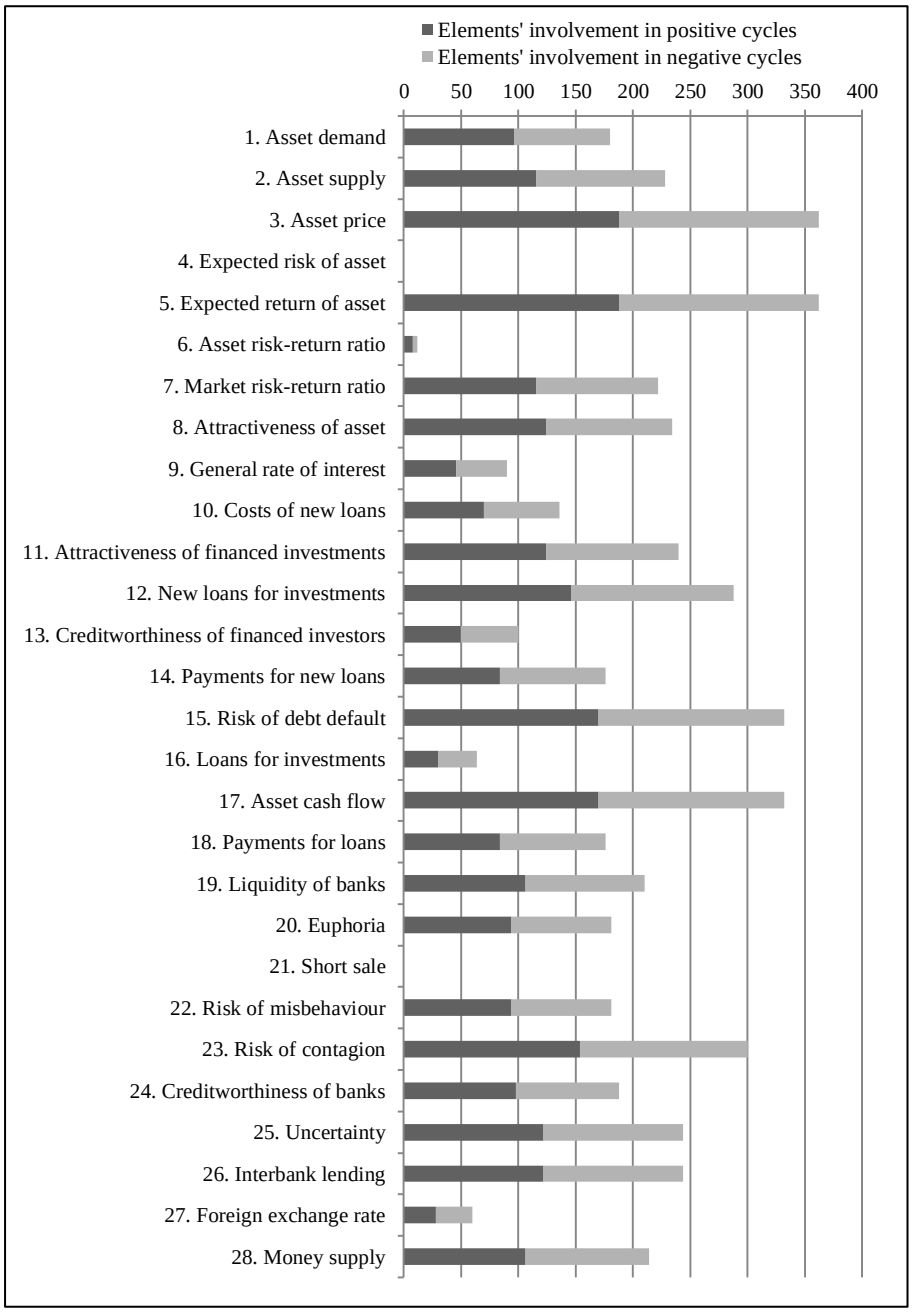


Figure 5-25: Involvement of elements in the cycles of Element 5 ("Expected return of asset")

Interpretation: The initial impulses of increasing or decreasing the Element "Expected return of asset" are slightly sustainable. 174 negative cycles are more than equalised by 188 positive cycles.

Element 6: Asset risk-return ratio

Results: The Element "Asset risk-return ratio" initiates 18 cycles. An increase or decrease of the Element "Asset risk-return ratio" cause 10 positive cycles, which amplify the initial impulse and 8 negative cycles reversing the initial impulse. 11.1% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

Negative cycles are longer than positive cycles. The mean is 11.3 for positive cycles and 14.0 for negative cycles. The median is 9.0 for positive cycles and 16.0 for negative cycles. The spreads of the lengths are identical for positive and negative cycles. For a detailed list of numbers please refer to Appendix 2.

The Element "Attractiveness of asset" is directly related and, therefore, more often involved in the cycles of Element 6. Indirectly, the Elements "Asset demand" and "Asset price" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-26 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

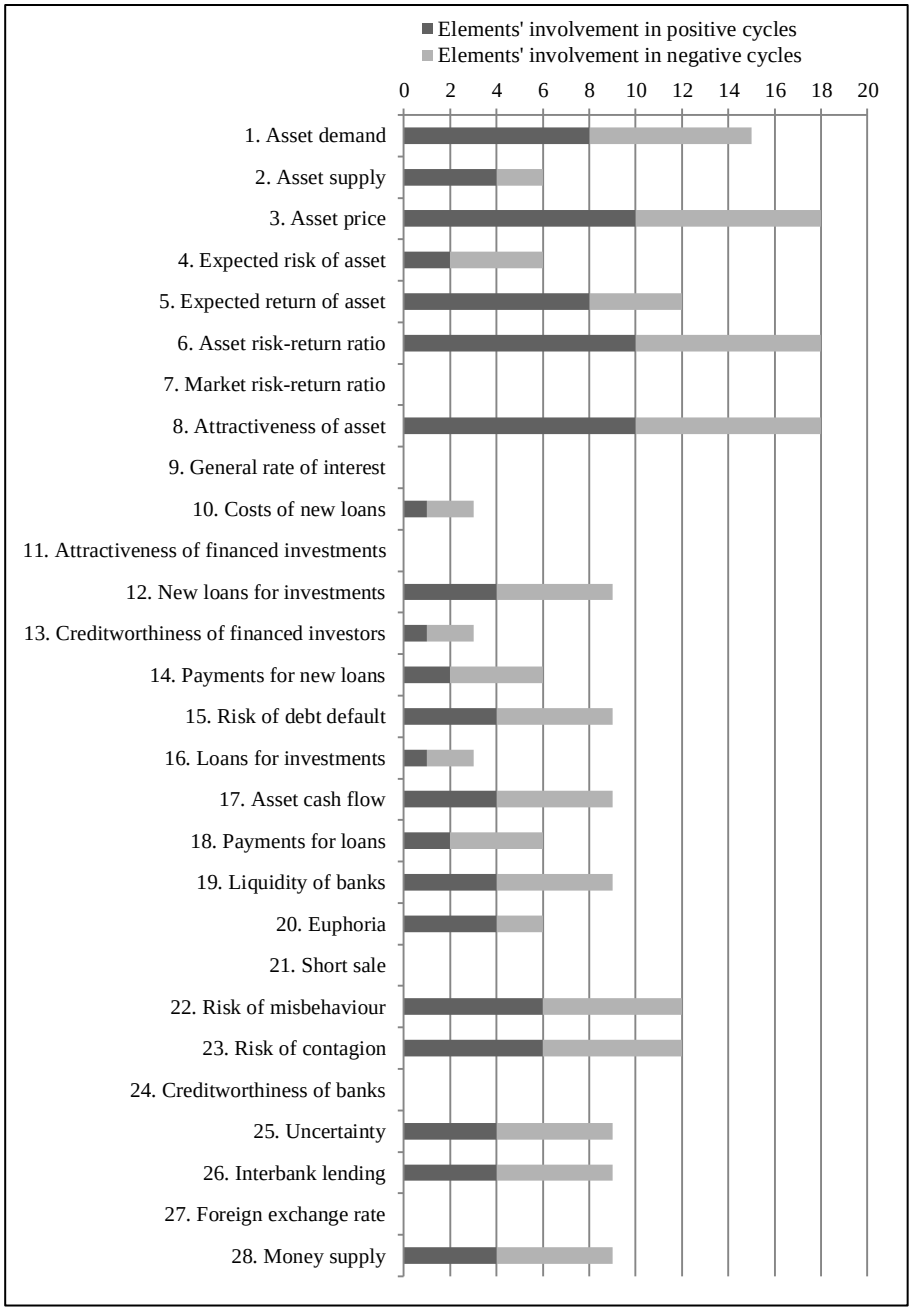


Figure 5-26: Involvement of elements in the cycles of Element 6 ("Asset risk-return ratio")

Interpretation: The initial impulses of increasing or decreasing the Element "Asset risk-return ratio" are sustainable. 8 negative cycles are more than equalised by 10 positive cycles. This effect is amplified by longer negative cycles.

Element 7: Market risk-return ratio

Results: The Element "Market risk-return ratio" initiates 327 cycles. An increase or a decrease of the Element "Market risk-return ratio" cause 169 positive cycles, which amplify the initial impulse and 158 negative cycles reversing the initial impulse. 3.4% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.8 for positive cycles and 16.3 for negative cycles. The median is 17.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-27 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

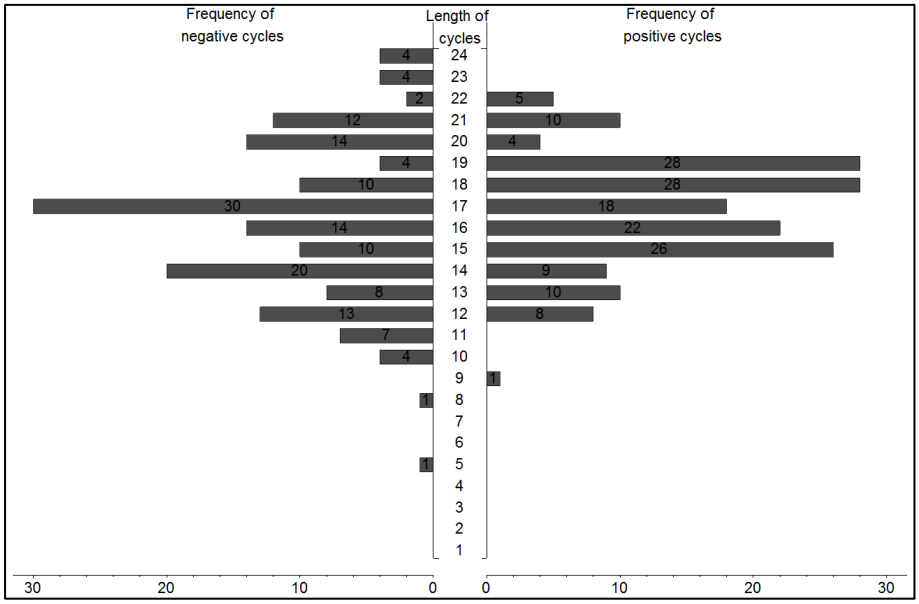


Figure 5-27: Lengths of the cycles of Element 7 ("Market risk-return ratio")

The Element "Attractiveness of asset" is directly related and, therefore, more often involved in the cycles of Element 7. Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are several significant exceptions. The Elements

"General rate of interest", "Costs of new loans", "Liquidity of banks" and "Foreign exchange rate" are more often involved in positive cycles. Figure 5-28 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

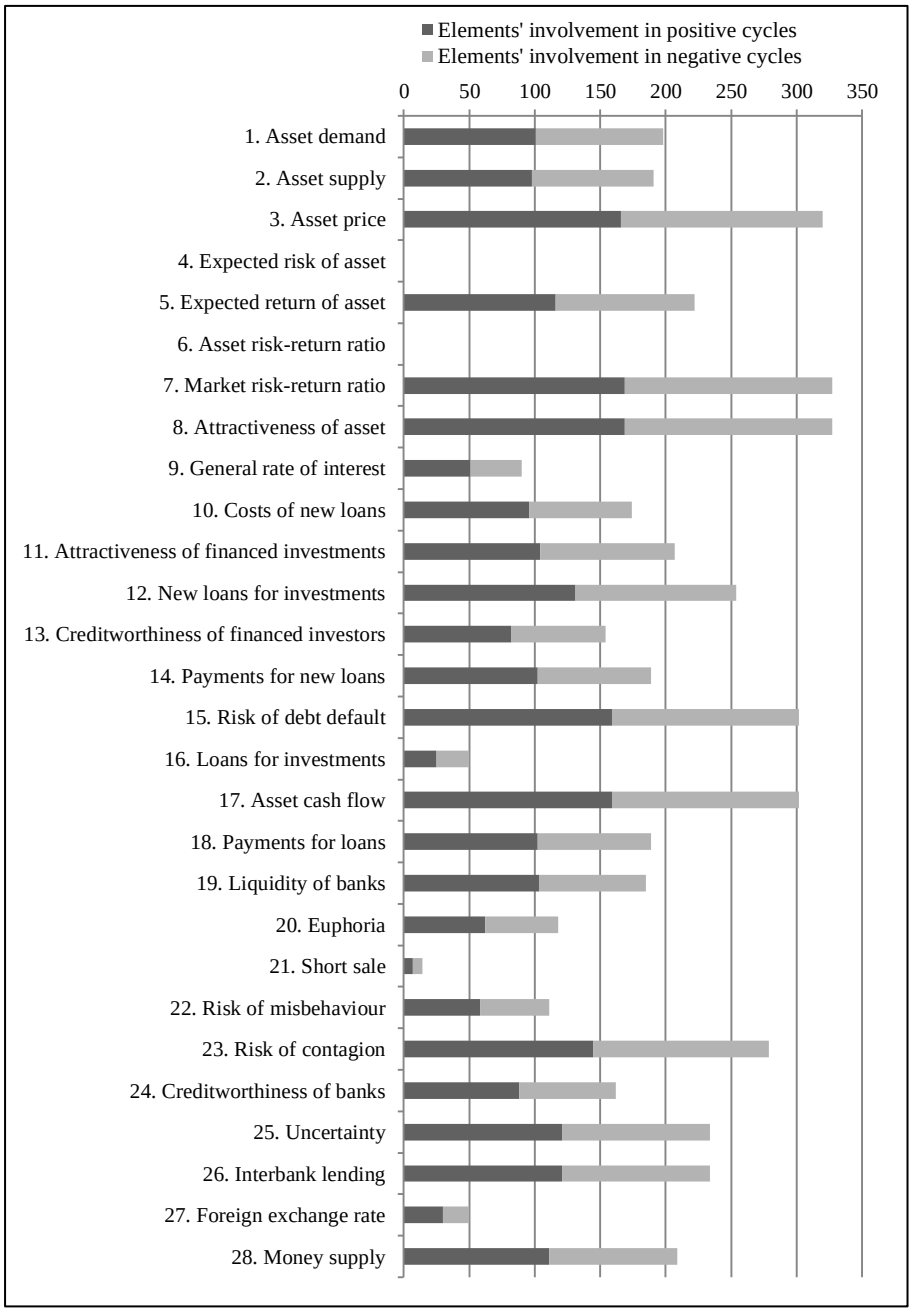


Figure 5-28: Involvement of elements in the cycles of Element 7 ("Market risk-return ratio")

Interpretation: The initial impulses of increasing or decreasing the Element "Market risk-return ratio" are slightly sustainable. 158 negative cycles are more

than equalised by 169 positive cycles.

Element 8: Attractiveness of asset

Results: The Element "Attractiveness of asset" initiates 345 cycles. An increase or a decrease of the Element "Attractiveness of asset" cause 179 positive cycles, which amplify the initial impulse and 166 negative cycles reversing the initial impulse. 3.8% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.5 for positive cycles and 16.2 for negative cycles. The median is 17.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-29 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

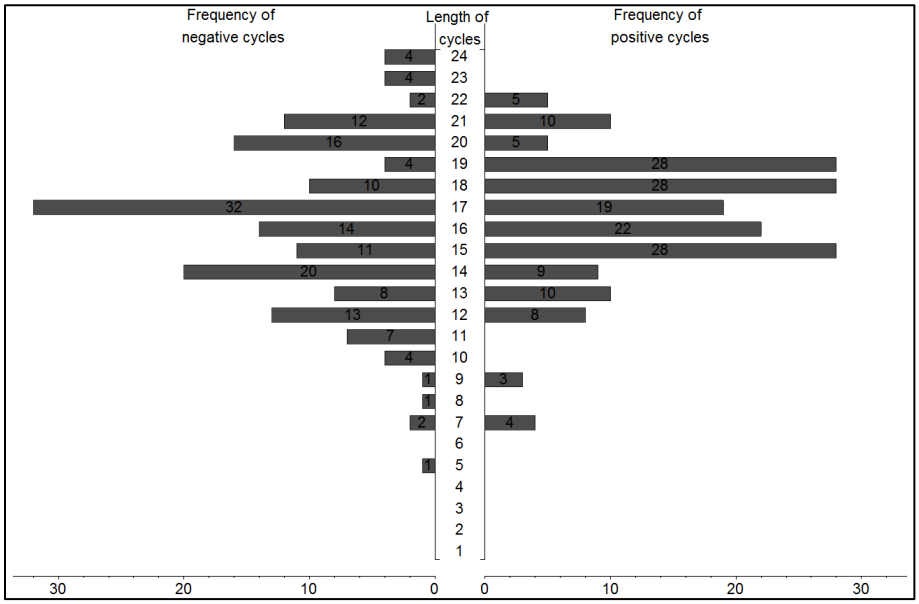


Figure 5-29: Lengths of the cycles of Element 8 ("Attractiveness of asset")

Indirectly, the Elements "Asset price", "Market risk-return ratio", "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles in the cycles of Element 8. In general, elements are equally involved in positive and negative cycles.

However, there are several significant exceptions. The Elements "General rate of interest", "Liquidity of banks" and "Foreign exchange rate" are more often involved in positive cycles. Figure 5-30 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

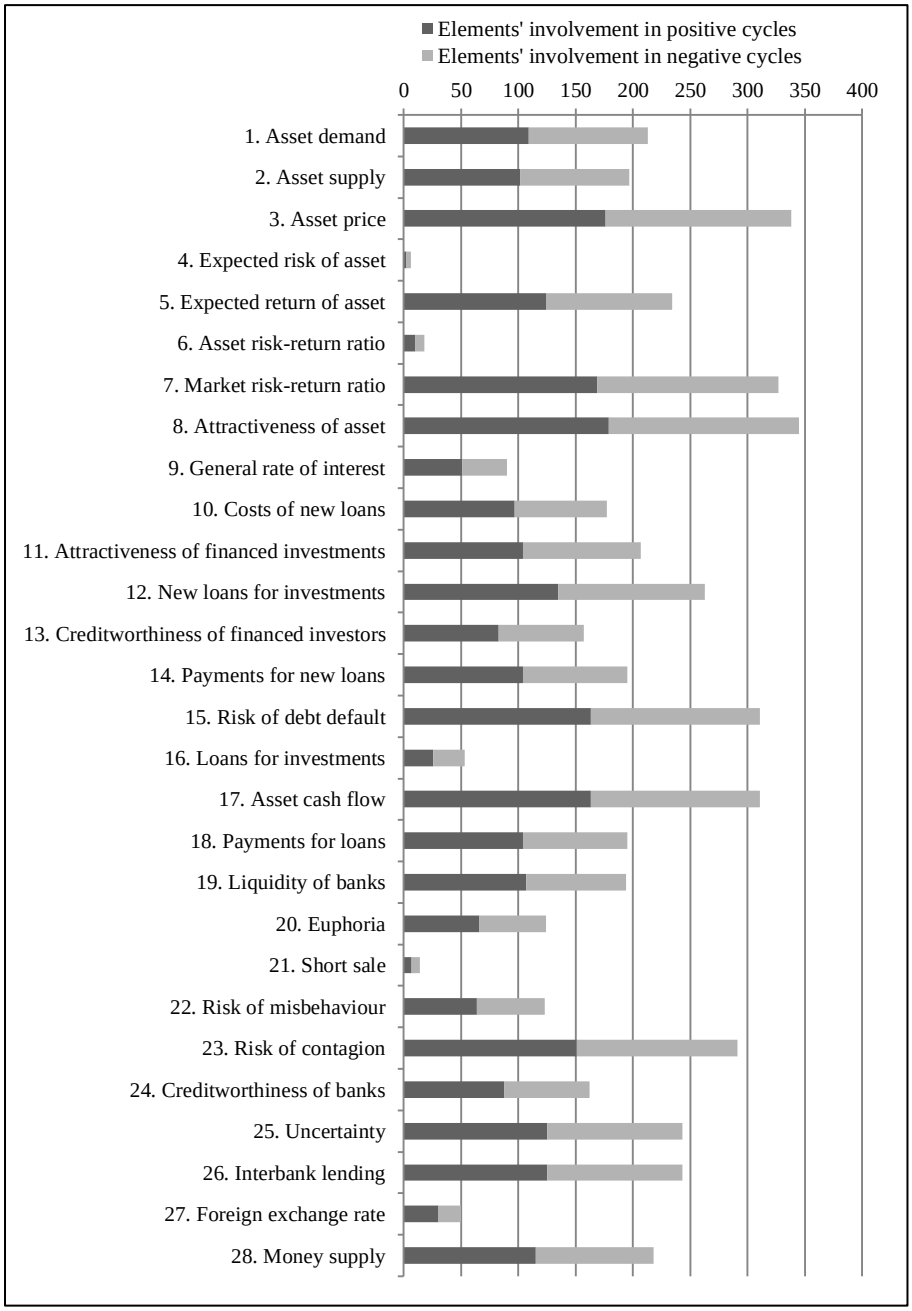


Figure 5-30: Involvement of elements in the cycles of Element 8 ("Attractiveness of asset")

Interpretation: The initial impulse of increasing or decreasing the Element "Attractiveness of asset" are slightly sustainable. 166 negative cycles are more than equalised by 179 positive cycles.

Element 10: Costs of new loans

Results: The Element "Costs of new loans" initiates 294 cycles. An increase or a decrease of the Element "Costs of new loans" cause 150 positive cycles, which amplify the initial impulse and 144 negative cycles reversing the initial impulse. 2.0% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.3 for positive cycles and 16.4 for negative cycles. The median is 16.5 for positive cycles and 17.0 for negative cycles. The spread of the lengths of negative cycles is greater. Figure 5-31 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

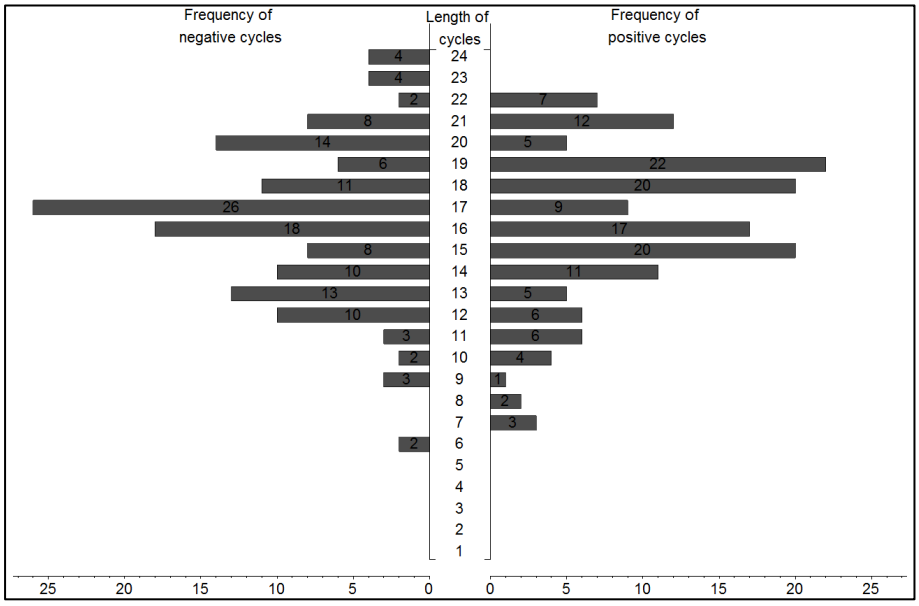


Figure 5-31: Lengths of the cycles of Element 10 ("Costs of new loans")

Next to other elements, the Element "Payments for new loans" is directly related and, therefore, more often involved in the cycles of Element 10. Indirectly, the Elements "Asset price", "New loans for investments",

"Creditworthiness of financed investors", "Risk of debt default", "Asset cash flow", "Payments for loans" and Risk of contagion" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there is one significant exception. The Element "Market risk-return ratio" is more often involved in positive cycles. Figure 5-32 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

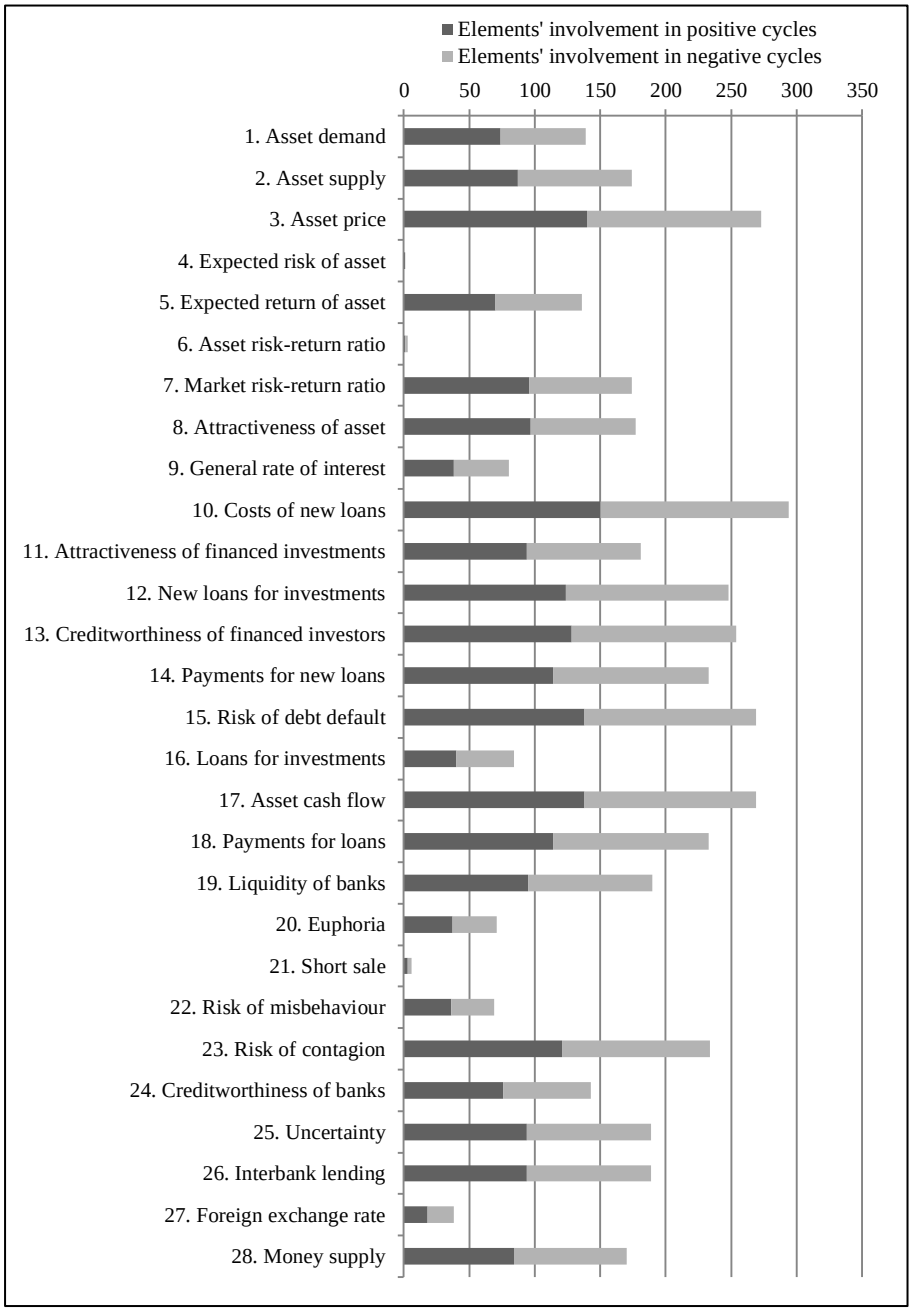


Figure 5-32: Involvement of elements in the cycles of Element 10 ("Costs of new loans")

Interpretation: The initial impulses of increasing or decreasing the Element "Costs of new loans" are slightly sustainable. 144 negative cycles are more than equalised by 150 positive cycles.

Element 11: Attractiveness of financed investments

Results: The Element "Attractiveness of financed investments" initiates 311 cycles. An increase or a decrease of the Element "Attractiveness of financed investments" cause 160 positive cycles, which amplify the initial impulse and 151 negative cycles reversing the initial impulse. 2.9% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.1 for positive cycles and 16.5 for negative cycles. The median is 16.0 for positive cycles and 17.0 for negative cycles. The spread of the lengths of negative cycles is greater. Figure 5-33 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

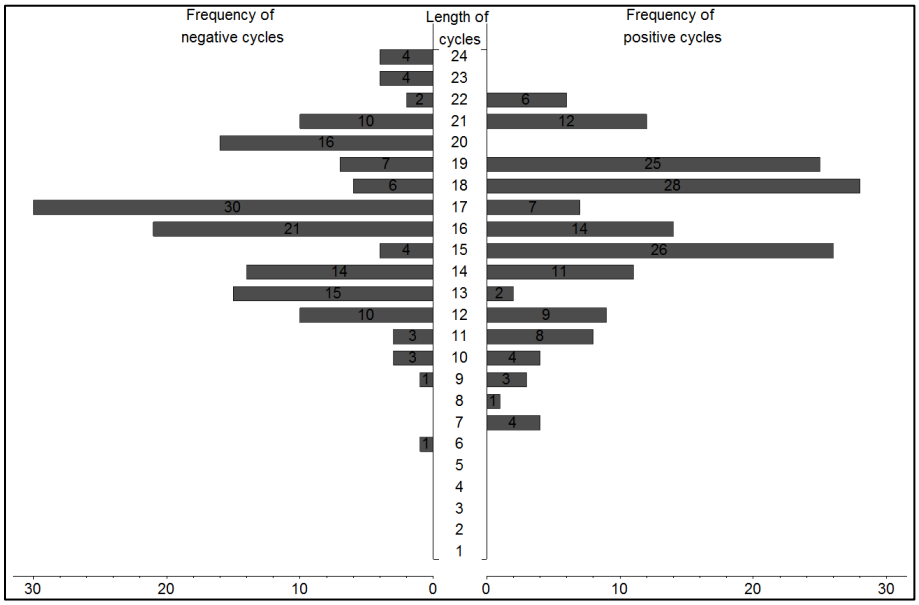


Figure 5-33: Lengths of the cycles of Element 11 ("Attractiveness of financed investments")

The Element "New loans for investments" is directly related and, therefore, more often involved in the cycles of Element 11. Indirectly,

the Elements “Asset price”, “Risk of debt default”, “Asset cash flow” and “Risk of contagion” play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-34 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

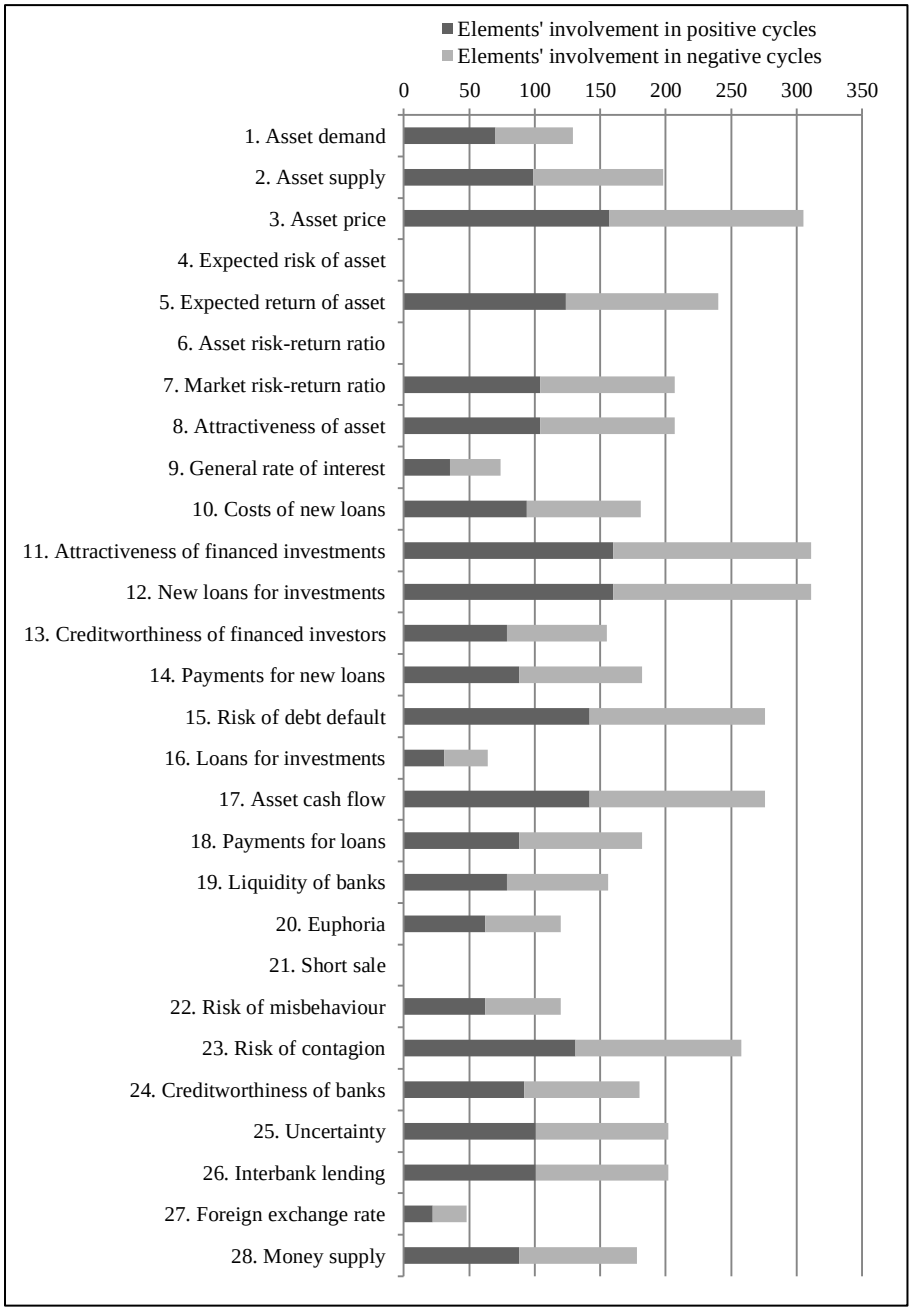


Figure 5-34: Involvement of elements in the cycles of Element 11 (“Attractiveness of financed investments”)

Interpretation: The initial impulses of increasing or decreasing the Element "Attractiveness of financed investments" are slightly sustainable. 151 negative cycles are more than equalised by 160 positive cycles.

Element 12: New loans for investments

Results: The Element "New loans for investments" initiates 447 cycles. An increase or a decrease of the Element "New loans for investments" cause 226 positive cycles, which amplify the initial impulse and 221 negative cycles reversing the initial impulse. 1.1% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.5 for positive cycles and 15.9 for negative cycles. The median is 16.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-35 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

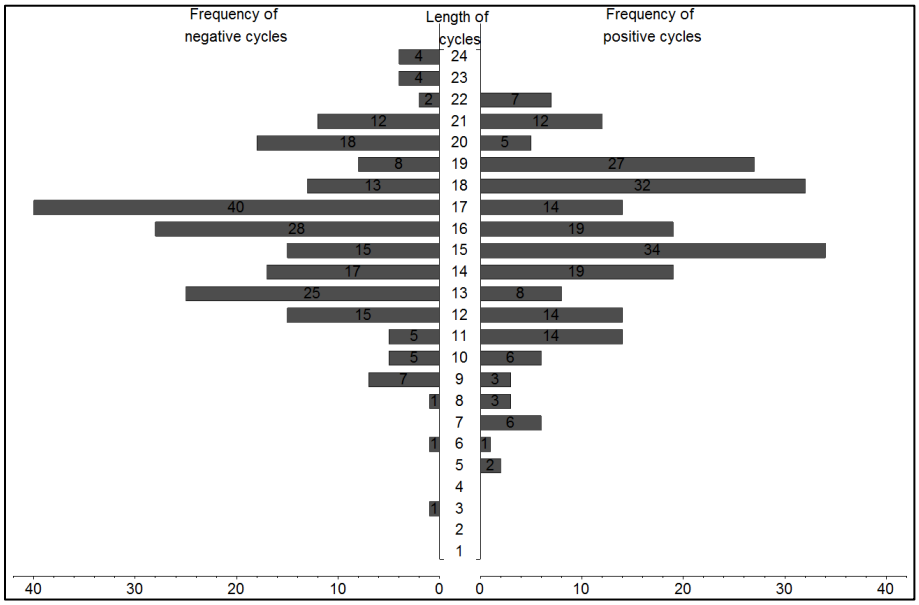


Figure 5-35: Lengths of the cycles of Element 12 ("New loans for investments")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in the cycles of Element 12.

Indirectly, the Elements “Asset price”, “Risk of debt default” and “Risk of contagion” play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are two significant exceptions. The Elements “General rate of interest” and “Foreign exchange rate” are more often involved in negative cycles. Figure 5-36 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

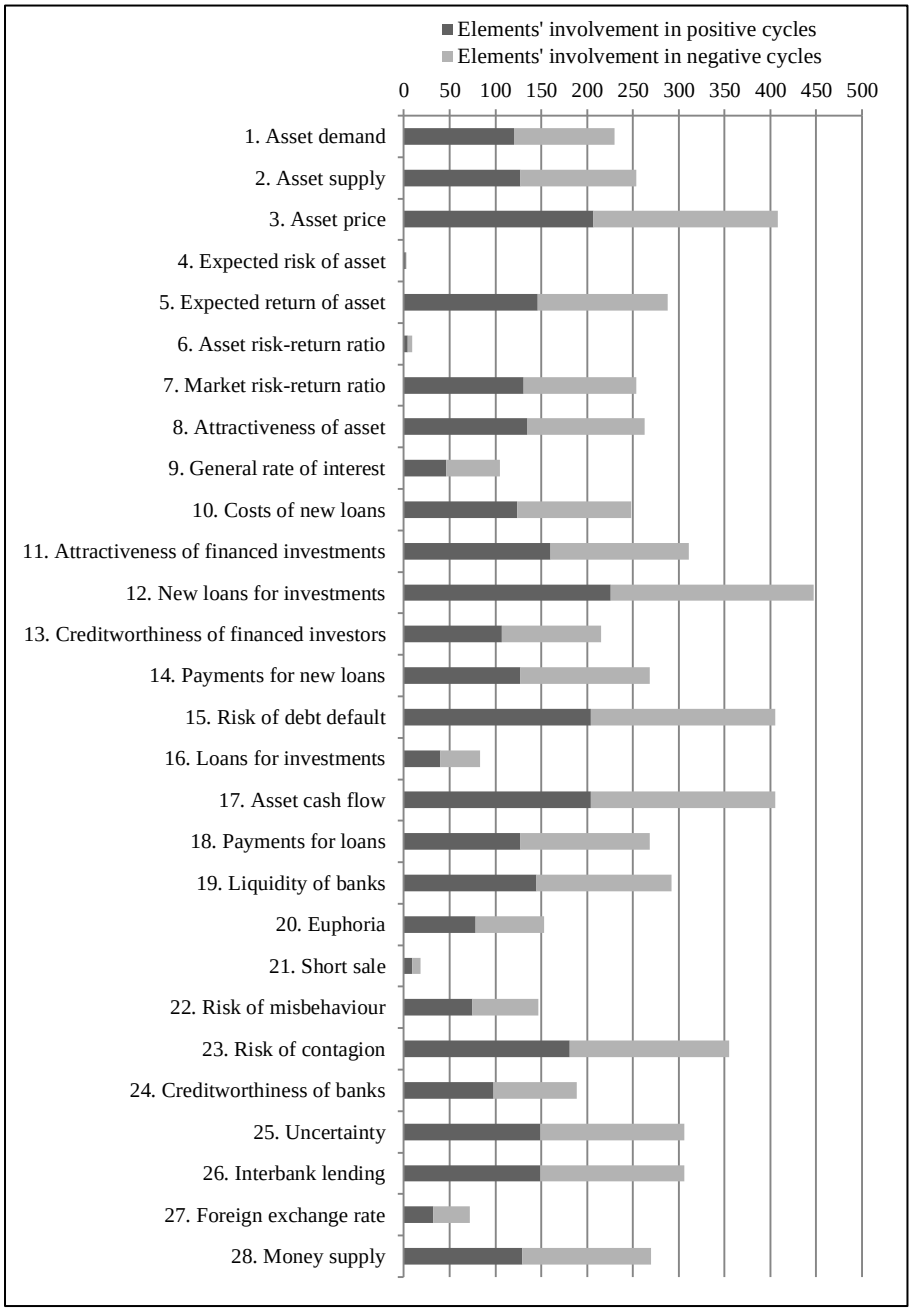


Figure 5-36: Involvement of elements in the cycles of Element 12 (“New loans for investments”)

Interpretation: The initial impulses of increasing or decreasing the Element "New loans for investments" are slightly sustainable. 221 negative cycles are more than equalised by 226 positive cycles.

Element 13: Creditworthiness of financed investors

Results: The Element "Creditworthiness of financed investors" initiates 254 cycles. An increase or a decrease of the Element "Creditworthiness of financed investors" cause 128 positive cycles, which amplify the initial impulse and 126 negative cycles reversing the initial impulse. 0.8% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.1 for positive cycles and 16.2 for negative cycles. The median is 16.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-37 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

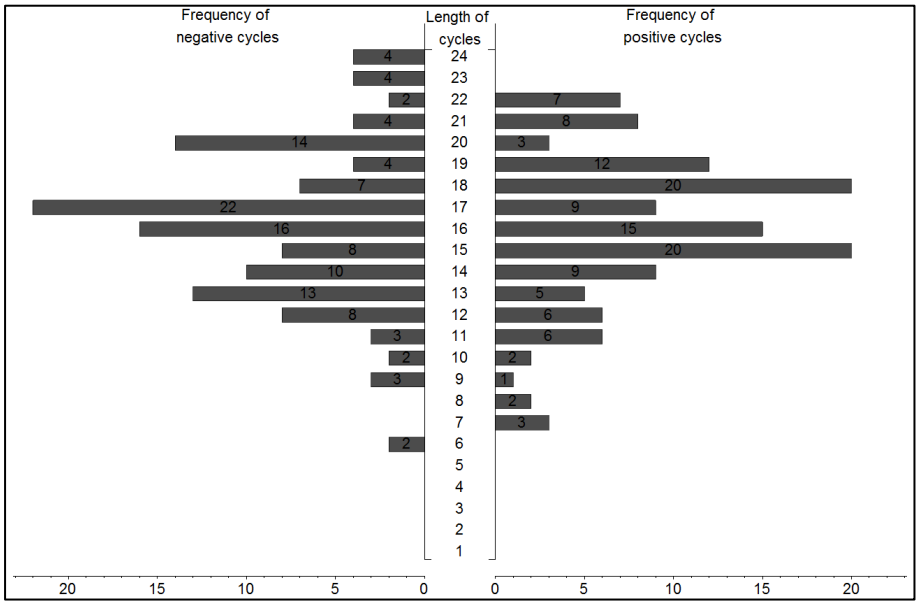


Figure 5-37: Lengths of the cycles of Element 13 ("Creditworthiness of financed investors")

The Element "Costs of new loans" is directly related and, therefore, more often involved in the cycles of Element 13 Indirectly, the Elements

"Asset price", "New loans for investments", "Payments for new loans", "Risk of debt default", "Asset cash flow", "Payments for loans" and "Risk of contagion" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there is one significant exception. The Element "General rate of interest" is more often involved in negative cycles. Figure 5-38 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

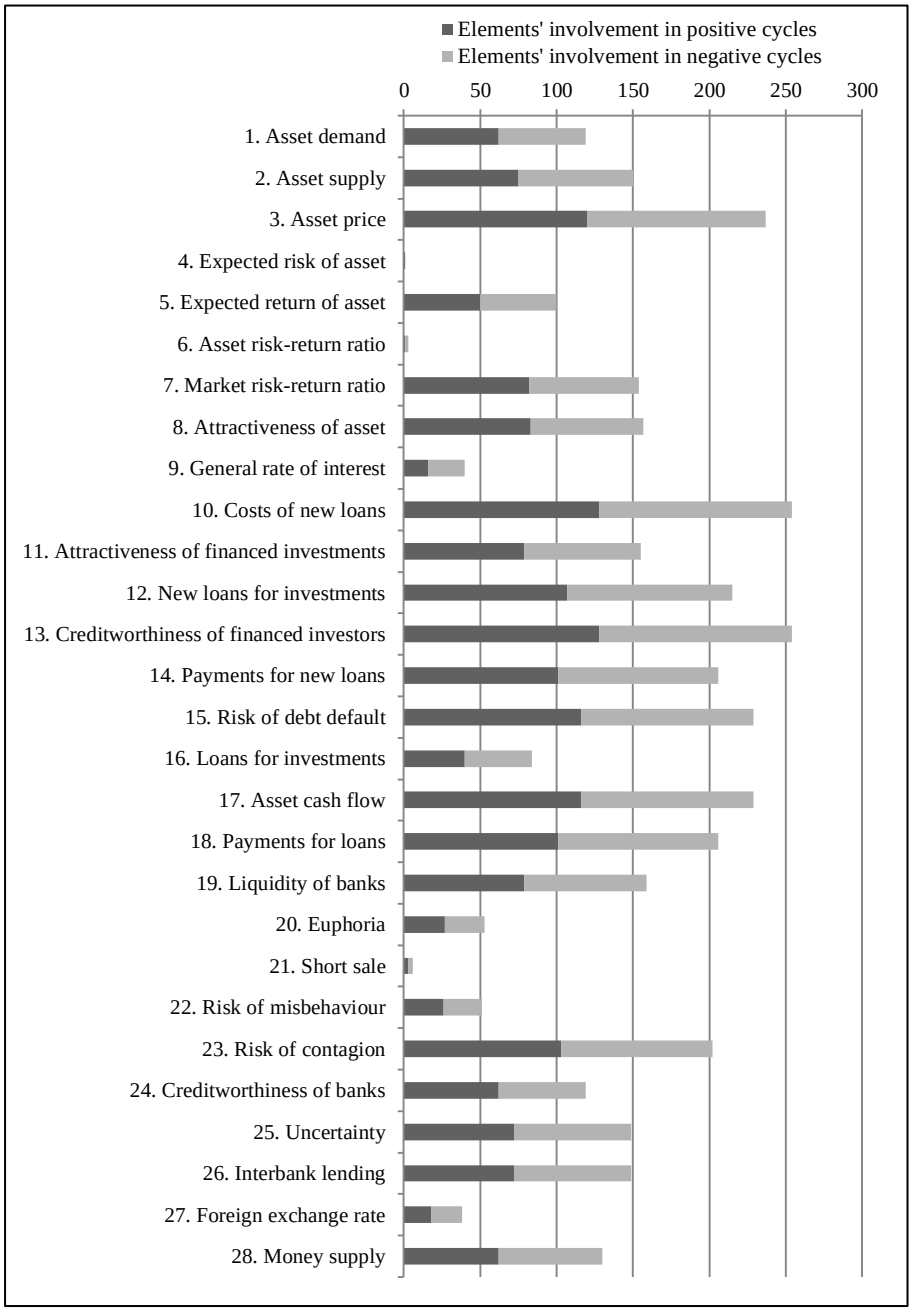


Figure 5-38: Involvement of elements in the cycles of Element 13 ("Creditworthiness of financed investors")

Interpretation: The initial impulses of increasing or decreasing the Element "Creditworthiness of financed investors" are slightly sustainable. 126 negative cycles are more than equalised by 128 positive cycles.

Element 14: Payments for new loans

Results: The Element "Payments for new loans" initiates 314 cycles. An increase or a decrease of the Element "Payments for new loans" cause 153 positive cycles, which amplify the initial impulse and 161 negative cycles reversing the initial impulse. 2.5% more negative cycles exist compared to positive cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.7 for positive cycles and 16.6 for negative cycles. The median is 17.0 for both. The spreads of the lengths of positive cycles and negative cycles are similar. Figure 5-39 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

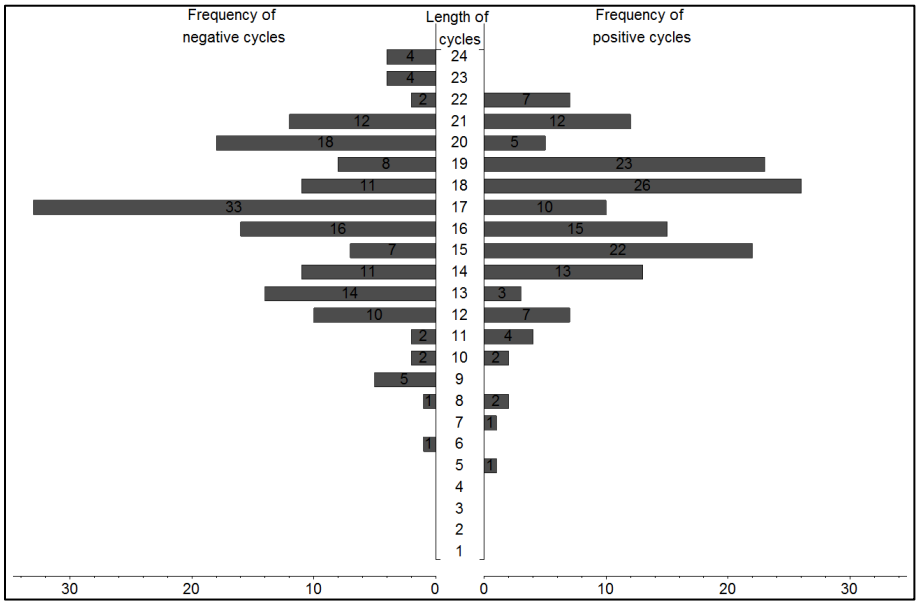


Figure 5-39: Lengths of the cycles of Element 14 ("Payments for new loans")

The Element "Payments for loans" is directly related and, therefore, more often involved in the cycles of Element 14. Indirectly, the Elements

"Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. In general, elements are equally involved in positive and negative cycles. However, there are two significant exceptions. The Elements "General rate of interest" and "Foreign exchange rate" are more often involved in negative cycles. Figure 5-40 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

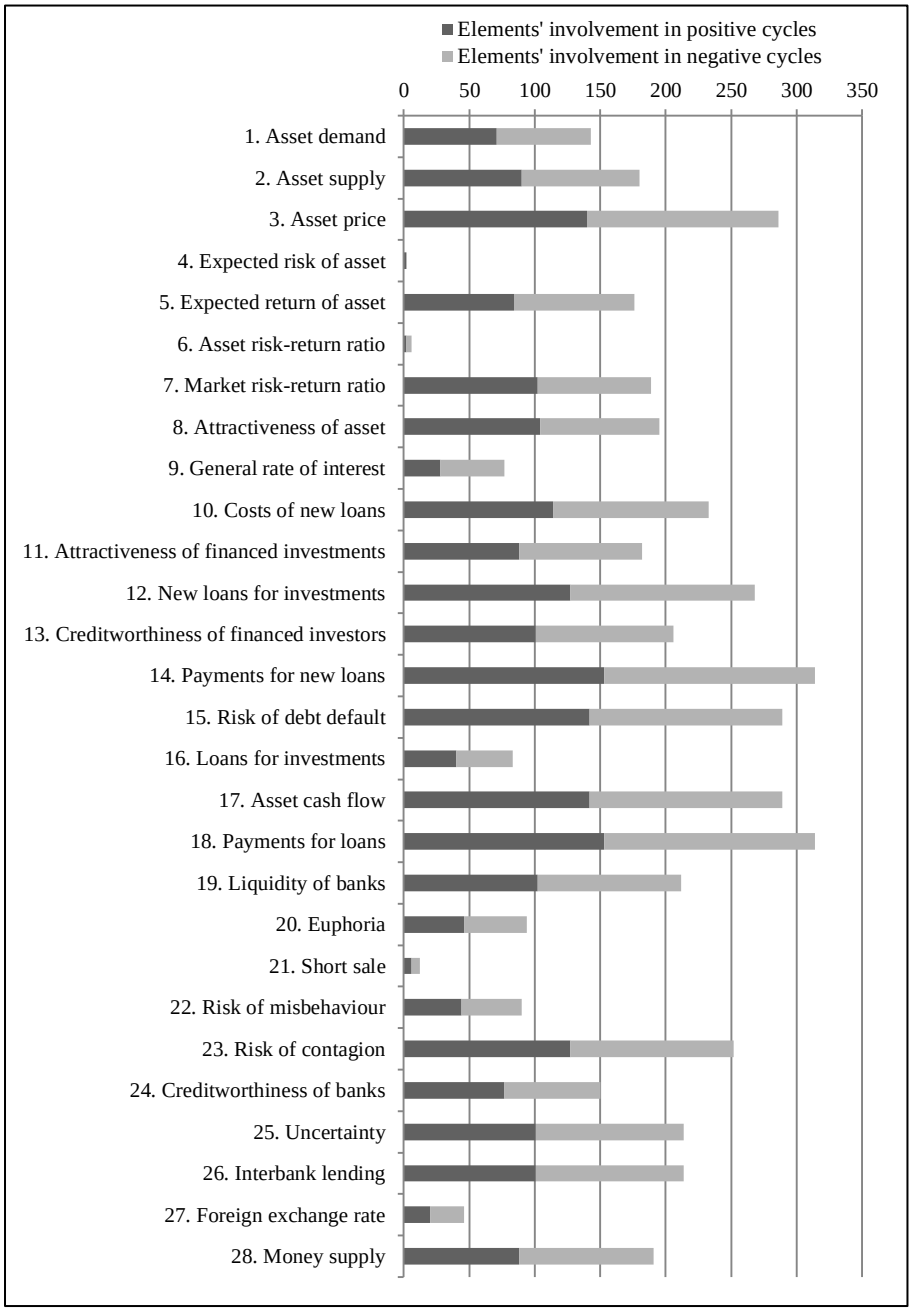


Figure 5-40: Involvement of elements in the cycles of Element 14 ("Payments for new loans")

Interpretation: The initial impulses of increasing or decreasing the Element "Payments for new loans" are unsustainable. 153 positive cycles are more than equalised by 161 negative cycles.

Element 15: Risk of debt default

Results: The Element "Risk of debt default" initiates 503 cycles. An increase or a decrease of the Element "Risk of debt default" cause 256 positive cycles, which amplify the initial impulse and 247 negative cycles reversing the initial impulse. 1.8% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.7 for positive cycles and 15.8 for negative cycles. The median is 16.0 for both. The spreads of the lengths of positive cycles and negative cycles are identical. Figure 5-41 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

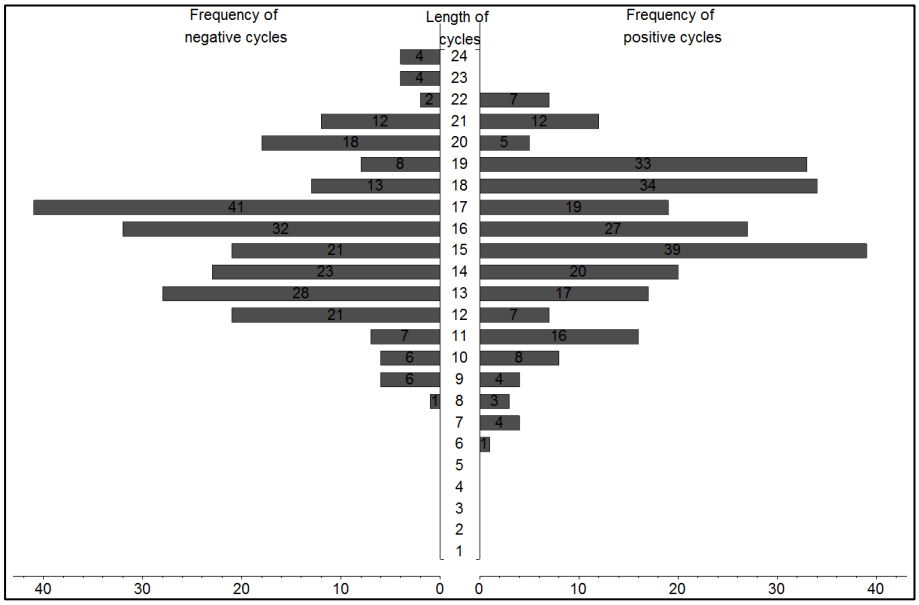


Figure 5-41: Lengths of the cycles of Element 15 ("Risk of debt default")

Next to other elements, the Element "Risk of contagion" is directly related and, therefore, more often involved in the cycles of Element 15. Indirectly, the Elements "Asset price", "New loans for investments" and

"Asset cash flow" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-42 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

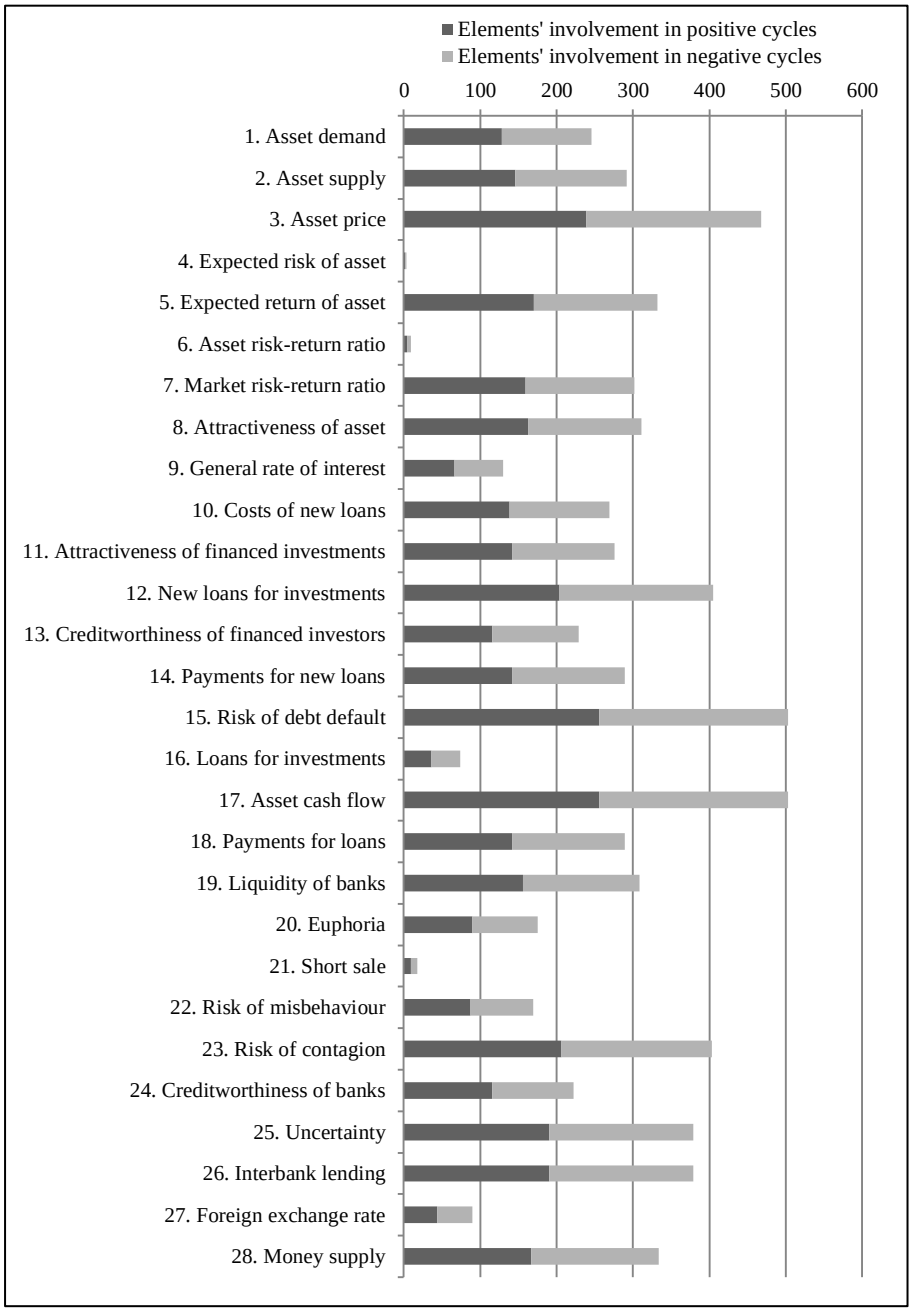


Figure 5-42: Involvement of elements in the cycles of Element 15 ("Risk of debt default")

Interpretation: The initial impulses of increasing or decreasing the Element "Risk of debt default" are slightly sustainable. 247 negative cycles are more than equalised by 256 positive cycles.

Element 16: Loans for investments

Results: The Element "Loans for investments" initiates 84 cycles. An increase or a decrease of the Element "Loans for investments" cause 40 positive cycles, which amplify the initial impulse and 44 negative cycles reversing the initial impulse. 4.8% more negative cycles exist compared to positive cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. Shorter negative cycles are equalised by longer negative cycles. The mean is 18.5 for positive cycles and 18.4 for negative cycles. The median is 19.0 for positive cycles and 20.0 for negative cycles. The spread of the lengths of negative cycles is greater. Figure 5-43 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

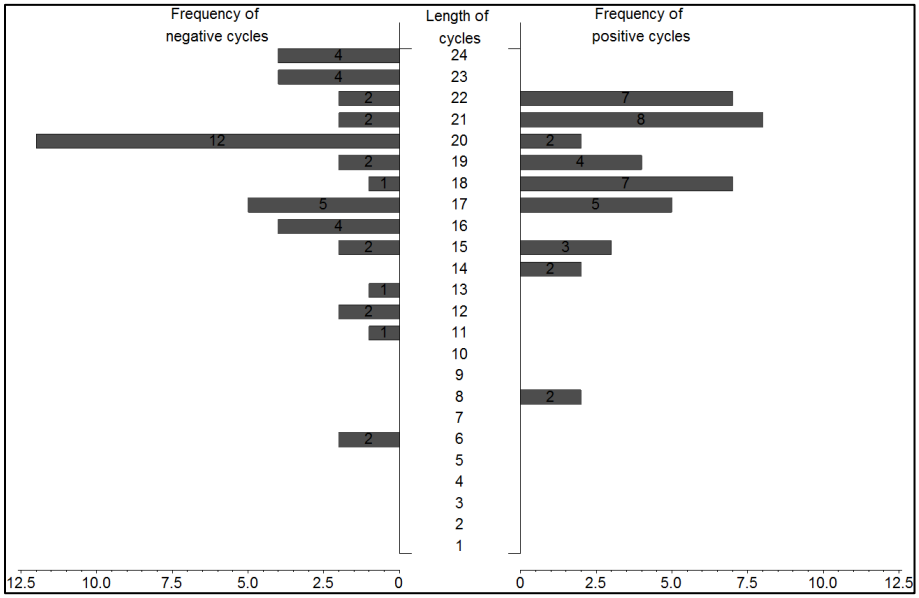


Figure 5-43: Lengths of the cycles of Element 16 ("Loans for investments")

The Element "Creditworthiness of financed investors" is directly related and, therefore, more often involved in the cycles of Element 16. Indirectly, the Elements "Asset price", "Costs for new loans", "New loans for investments", "Payments for new loans", "Risk of debt default", "Asset cash flow" and "Payments for loans" play significant roles. Elements are equally involved in positive and negative cycles.

Figure 5-44 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

Figure 5-44: Involvement of elements in the cycles of Element 16 ("Loans for investments")

Interpretation: The initial impulses of increasing or decreasing the Element "Loans for investments" are unsustainable. 40 positive cycles are more than equalised by 44 negative cycles.

Element 20: Euphoria

Results: The Element "Euphoria" initiates 194 cycles. An increase or a decrease of the Element "Euphoria" cause 101 positive cycles, which amplify the initial impulse and 93 negative cycles reversing the initial impulse. 4.1% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.5 for positive cycles and 15.9 for negative cycles. The median is 16.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-45 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

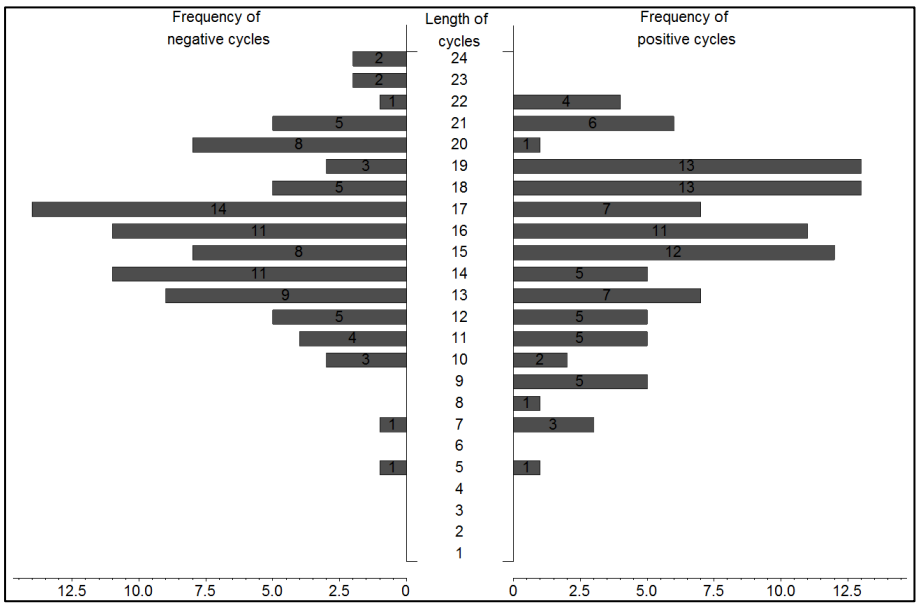


Figure 5-45: Lengths of the cycles of Element 20 ("Euphoria")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in the cycles of Element 20. Indirectly, the Elements "Asset price, "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-46 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

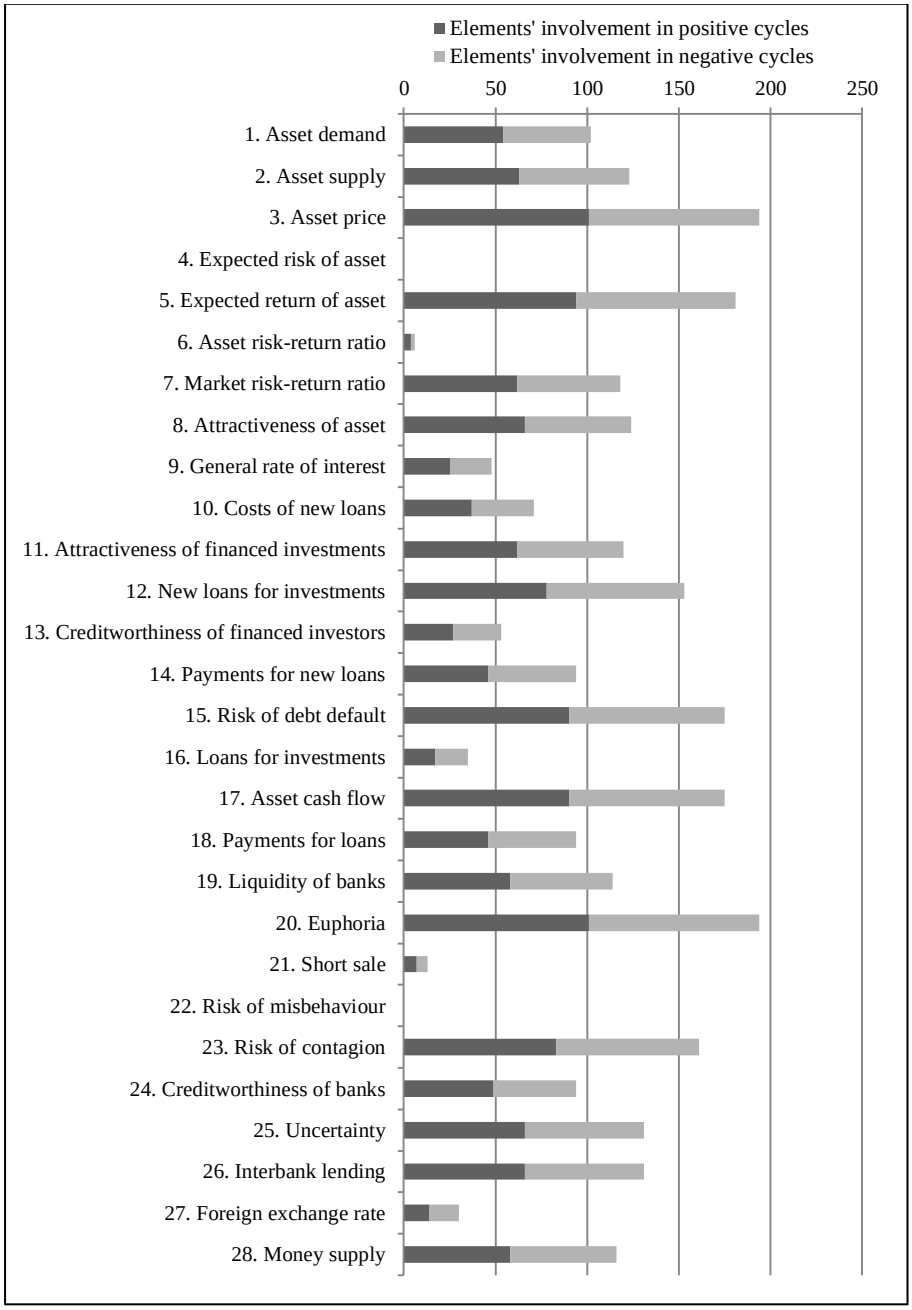


Figure 5-46: Involvement of elements in the cycles of Element 20 ("Euphoria")

Interpretation: The initial impulses of increasing or decreasing the Element "Euphoria" are slightly sustainable. 93 negative cycles are more than equalised by 101 positive cycles.

Element 22: Risk of misbehaviour

Results: The Element "Risk of misbehaviour" initiates 187 cycles. An increase or a decrease of the Element "Risk of misbehaviour" cause 96 positive cycles, which amplify the initial impulse and 91 negative cycles reversing the initial impulse. 2.7% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.6 for positive cycles and 15.8 for negative cycles. The median is 16.0 for both. The spread of the lengths of negative cycles is greater. Figure 5-47 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

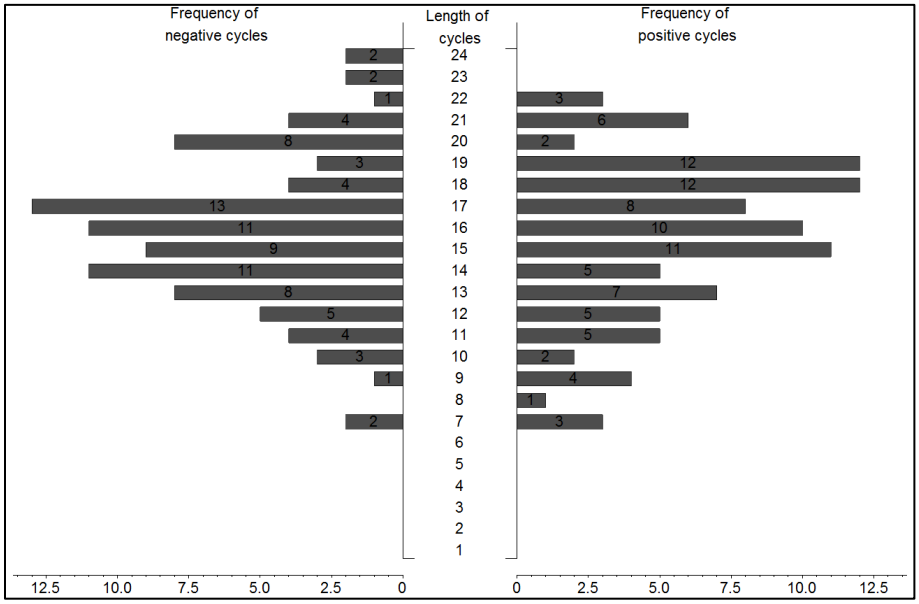


Figure 5-47: Lengths of the cycles of Element 22 ("Risk of misbehaviour")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in the cycles of Element 22. Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-48 shows the respective distribution. For a detailed list

of numbers please refer to Appendix 3.

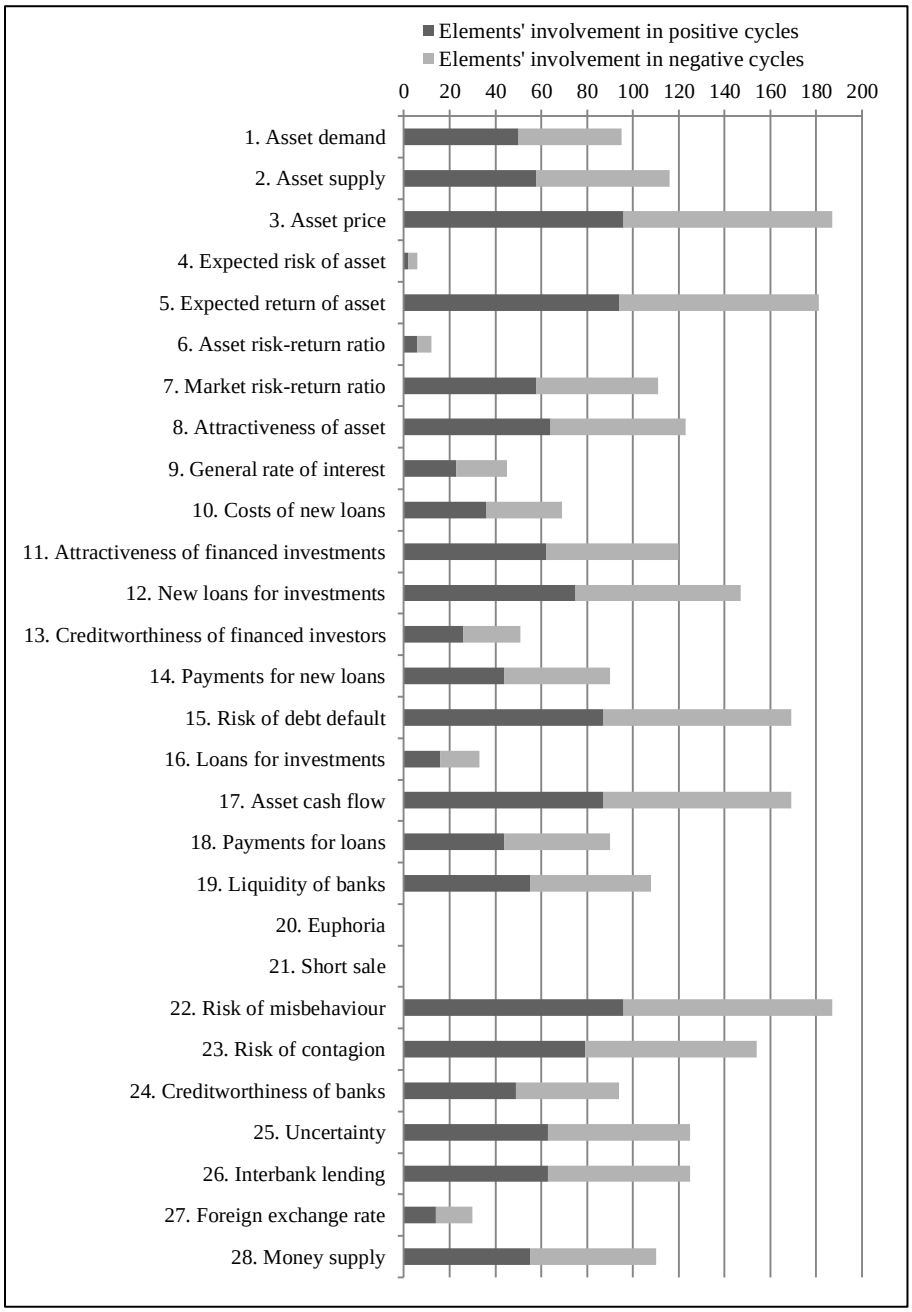


Figure 5-48: Involvement of elements in the cycles of Element 22 ("Risk of misbehaviour")

Interpretation: The initial impulses of increasing or decreasing the Element "Risk of misbehaviour" are slightly sustainable. 91 negative cycles are more than equalised by 96 positive cycles.

Element 23: Risk of contagion

Results: The Element "Risk of contagion" initiates 448 cycles. An increase or a decrease of the Element "Risk of contagion" cause 229 positive cycles, which amplify the initial impulse and 219 negative cycles reversing the initial impulse. 2.2% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 15.7 for positive and negative cycles. The median is 16.0 for both. The spreads of the lengths of positive cycles and negative cycles are similar. Figure 5-49 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

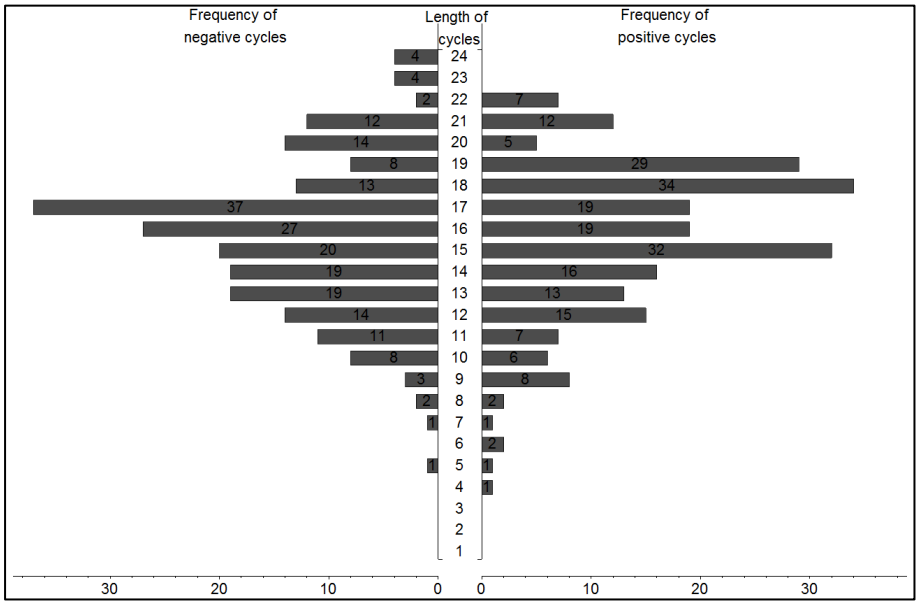


Figure 5-49: Lengths of the cycles of Element 23 ("Risk of contagion")

Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles in the cycles of Element 23. Elements are equally involved in positive and negative cycles. Figure 5-50 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

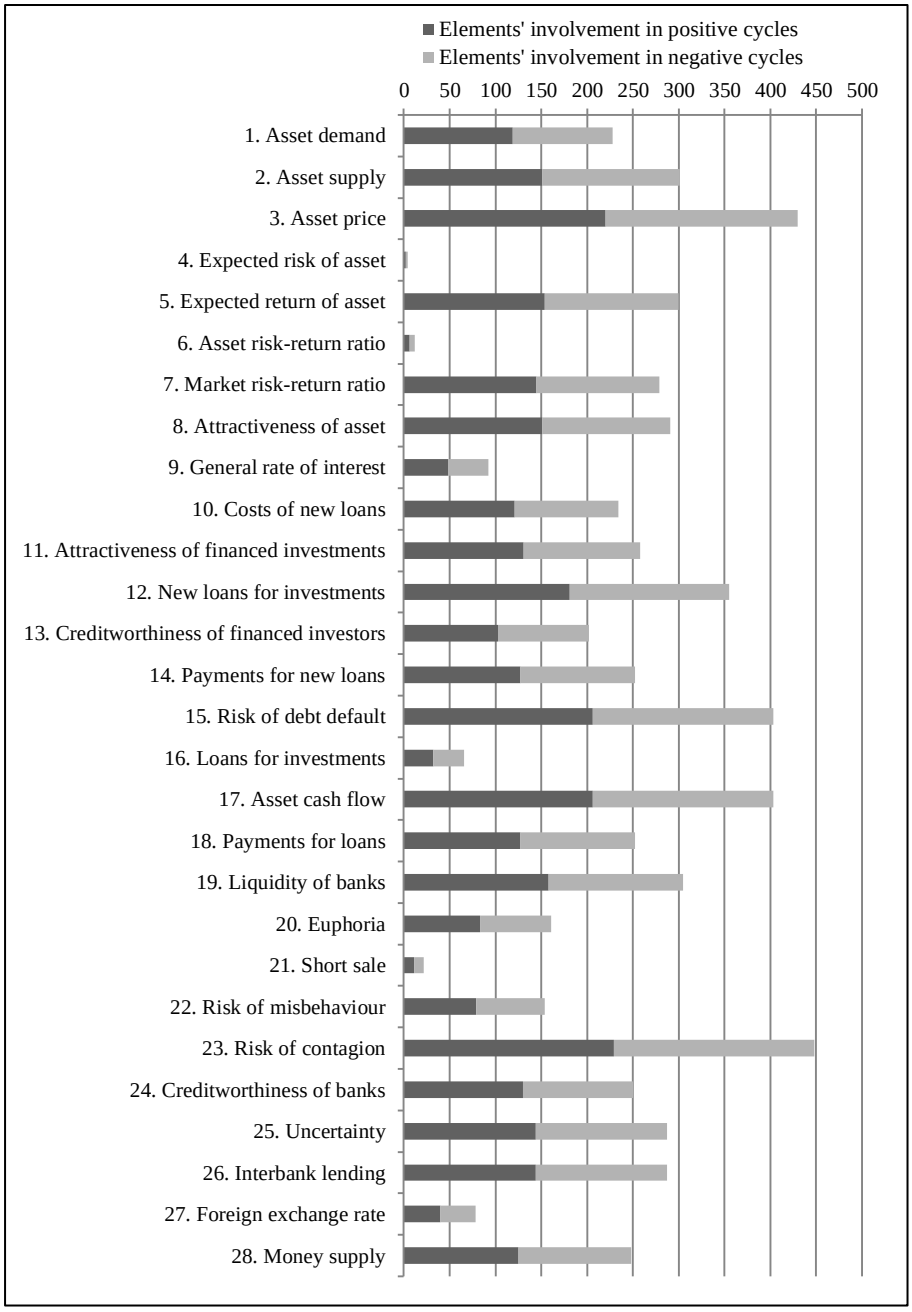


Figure 5-50: Involvement of elements in the cycles of Element 23 ("Risk of contagion")

Interpretation: The initial impulses of increasing or decreasing the Element "Risk of contagion" are slightly sustainable. 219 negative cycles are more than equalised by 229 positive cycles.

Element 26: Interbank lending

Results: The Element "Interbank lending" initiates 379 cycles. An increase or a decrease of the Element "Interbank lending" cause 190 positive cycles, which amplify the initial impulse and 189 negative cycles reversing the initial impulse. 0.3% more positive cycles exist compared to negative cycles. For a detailed list of cycles please refer to Appendix 1.

The lengths of positive and negative cycles are similar. The mean is 16.4 for positive cycles and 16.6 for negative cycles. The mean is 17.0 for both. The spreads of the lengths of positive cycles and negative cycles are identical. Figure 5-51 shows the respective histograms. For a detailed list of numbers please refer to Appendix 2.

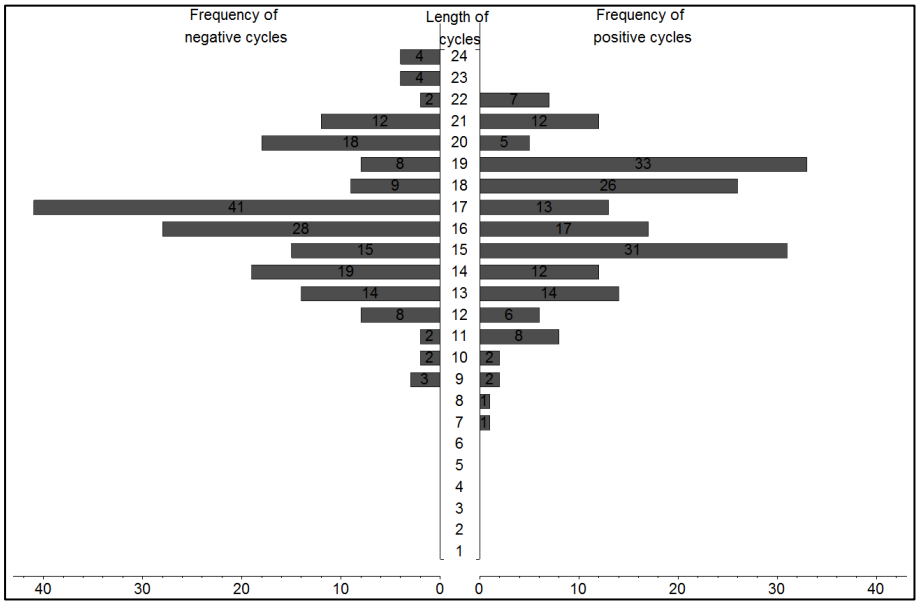


Figure 5-51: Lengths of the cycles of Element 26 ("Interbank lending")

Next to other elements, the Element "Money supply" is directly related and, therefore, more often involved in the cycles of Element 26. Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow", "Risk of contagion" and "Uncertainty" play significant roles. Elements are equally involved in positive and negative cycles. Figure 5-52 shows the respective distribution. For a detailed list of numbers please refer to Appendix 3.

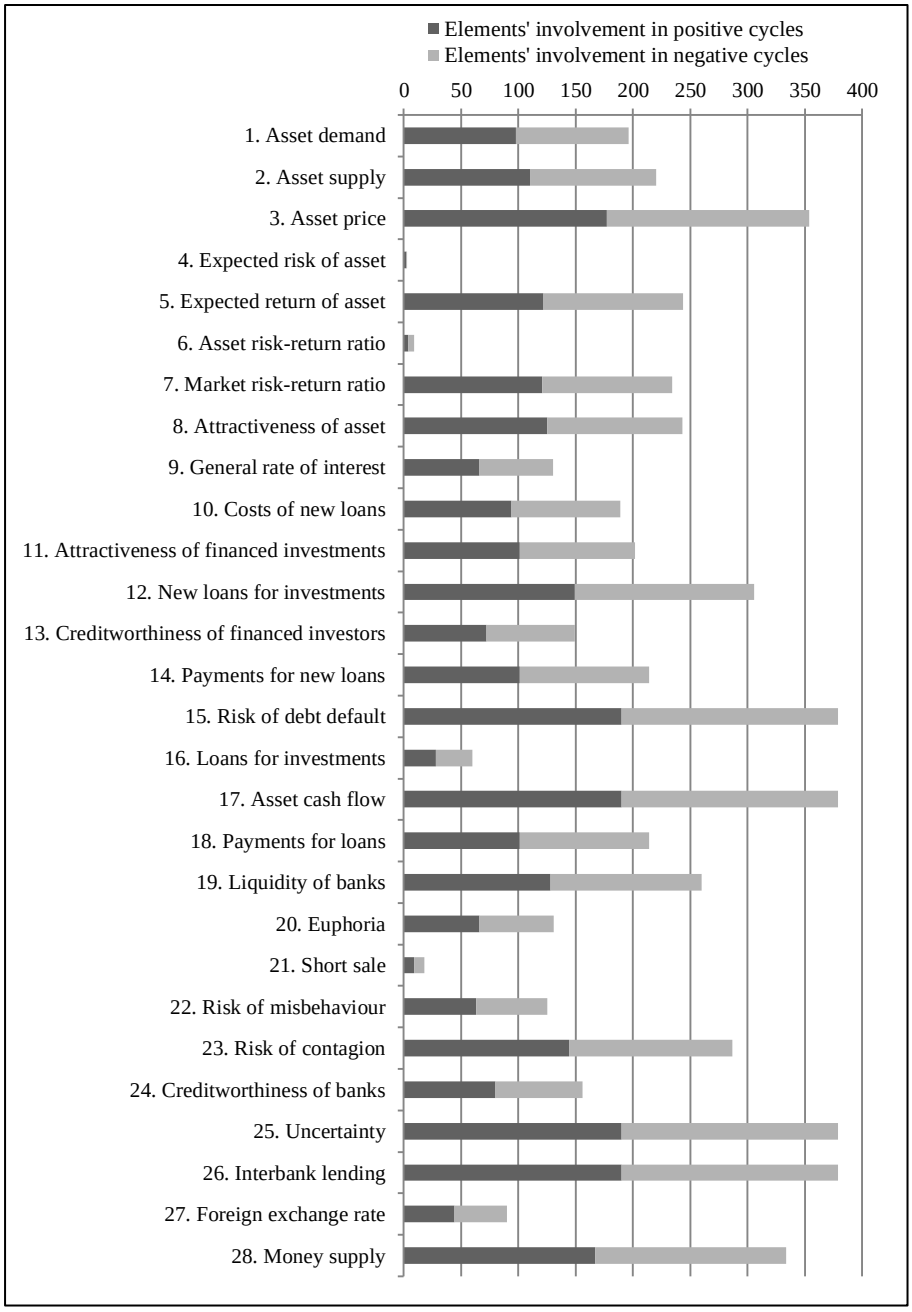


Figure 5-52: Involvement of elements in the cycles of Element 26 ("Interbank lending")

Interpretation: The initial impulses of increasing or decreasing the Element "Interbank lending" are slightly sustainable. 189 negative cycles are more than equalised by 190 positive cycles.

Summary of results

This research specifies sustainability as a characteristic of actions. An action can be seen as sustainable if an intended effect of an action is repeated without the initiation of new actions. The sustainability of potential new actions can be measured by identifying long-term consequences of an initial impulse. Cycles are counted and analysed (see Chapter 3.3.2).

The results of the analyses of potential new actions are summarised in Table 5-2. The table shows the linked element for each potential new action and the classification as sustainable, slightly sustainable or unsustainable, including the overall number of cycles, the number of positive cycles and the number of negative cycles.

Only the potential new actions of "Decreasing of asset demand" and "Increasing or decreasing of asset risk-return ratio" can be seen as sustainable. The majority of potential actions are categorised as slightly sustainable. The Elements "Expected risk of asset", "Payments for new loans", "Loans for investments", "Payments for loans", "Short sales" and "Money supply" are unsustainable.

Table 5-2: Summary of sustainability for potential new actions

#	Potential new action	Sustainable	Slightly sustainable	Un-sustainable
1[20]	Decreasing of asset demand	Yes 282-148-134	No	No
2	Increasing of decreasing of asset supply	No	Yes 331-167-164	No
4	Increasing of decreasing of expected risk of asset	No	No	Yes 6-2-4
5	Increasing of decreasing of expected return of asset	No	Yes 362-188-174	No
6	Increasing of decreasing of asset risk-return ratio	Yes 18-10-8	No	No
7	Increasing of decreasing of market risk-return ratio	No	Yes 327-169-158	No
8	Increasing of decreasing of attractiveness of asset	No	Yes 345-179-166	No
10	Increasing of decreasing of costs of new loans	No	Yes 294-150-144	No

[20] Data based on analyses of the previous section

#	Potential new action	Sustainable	Slightly sustainable	Un-sustainable
11	Increasing of decreasing of attractiveness of financed investments	No	Yes 311-160-151	No
12	Increasing of decreasing of new loans for investments	No	Yes 447-226-221	No
13	Increasing of decreasing of creditworthiness of financed investors	No	Yes 254-128-126	No
14	Increasing of decreasing of payments for new loans	No	No	Yes 314-153-161
15	Increasing of decreasing of risk of debt default	No	Yes 503-256-247	No
16	Increasing of decreasing of loans for investments	No	No	Yes 84-40-44
17[20]	Decreasing of asset cash flow	No	Yes 503-256-247	No
18[20]	Increasing of payments for loans	No	No	Yes 314-153-161
19[20]	Decreasing of liquidity of banks	No	Yes 344-174-170	No
20	Increasing of decreasing of euphoria	No	Yes 194-101-93	No
21[20]	Increasing of short sales	No	No	Yes 26-13-13
22	Increasing of decreasing of risk of misbehaviour	No	Yes 184-96-91	No
23	Increasing of decreasing of risk of contagion	No	Yes 448-229-219	No
24[20]	Decreasing of creditworthiness of banks	No	Yes 250-130-120	No
25[20]	Increasing of uncertainty	No	Yes 379-190-189	No
26	Increasing of decreasing of interbank lending	No	Yes 379-190-189	No
28[20]	Decreasing of money supply	No	No	Yes 324-167-167

The last two sections showed the results of the sustainability analysis. The results for both, identified actions and potential new actions, were outlined. The next section contains the analysis of the strength of actions.

5.2 Systemic roles of elements

This part of the thesis contains the documentation of the analysis of the systemic role of elements. For each element ingoing and outgoing interrelations and their intensities are identified and classified (the details of the method are described in Chapter 3.3.3). The first

section starts with identified actions, while the second contains potential new actions. A summary of this analysis of identified actions is documented on page 208 and that of potential new actions on page 215.

5.2.1 Analysis of identified actions

Element 1: Asset demand

Relevance: Action 1-6 "Asset purchases from markets"

Results: The Element "Asset demand" has an active sum of 4 and a passive sum of 7. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Asset demand" is a passive element.

Interpretation: Changes in the system should not be initiated by the passive Element "Asset demand".

Element 3: Asset price

Relevance: Action 3-7 "Bank holidays on exchanges"

Results: The Element "Asset price" has an active sum of 8 and a passive sum of 6. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Asset price" is a critical element.

Interpretation: Changes in the system should not be initiated by the critical Element "Asset price".

Element 9: General rate of interest

Relevance: Action 1-2 "Increasing of general interest rate"
Action 1-3 "Decreasing of general interest rate"

Results: The Element "General rate of interest" has an active sum of 6 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "General rate of interest" is an active element.

Interpretation: Changes in the system may be initiated by the active Element "General rate of interest".

Element 17: Asset cash flow

Relevance: Action 2-2 "Provision of liquidity to financed investors"

Results: The Element "Asset cash flow" has an active sum of 2 and a passive sum of 5. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Asset cash flow" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Asset cash flow".

Element 18: Payments for loans

Relevance: Action 3-4 “Debt moratoria for financed investors”

Results: The Element “Payments for loans” has an active sum of 6 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element “Payments for loans” is an active element.

Interpretation: Changes in the system may be initiated by the active Element “Payments for loans”.

Element 19: Liquidity of banks

Relevance: Action 1-7 “Asset purchases from banks”
Action 2-1 “Provision of liquidity to banks”
Action 2-3 “Provision of foreign liquidity”
Action 3-2 “Asset purchase programme”
Action 3-6 “Deposit freezing or bank holidays”

Results: The Element “Liquidity of banks” has an active sum of 4 and a passive sum of 11. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element “Liquidity of banks” is a passive element.

Interpretation: Changes in the system should not be initiated by the passive Element “Liquidity of banks”.

Element 21: Short sales

Relevance: Action 3-9 "Prohibition of short sales"

Results: The Element "Short sales" has an active sum of 4 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Short sales" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Short sales".

Element 24: Creditworthiness of banks

Relevance: Action 1-8 "Lightening of collateral requirements"
Action 3-1. "Deposit insurance, guarantees and nationalisation"
Action 3-3 "Asset transfer programme"
Action 3-5 "Accounting discretion"

Results: The Element "Creditworthiness of banks" has an active sum of 2 and a passive sum of 3. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Creditworthiness of banks" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Creditworthiness of banks".

Element 25: Uncertainty

Relevance: Action 3-8 "Stress tests"

Results: The Element "Uncertainty" has an active sum of 2 and a passive sum of 1. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Uncertainty" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Uncertainty".

Element 27: Foreign exchange rate

Relevance: Action 1-4 "Appreciation of domestic currency"
Action 1-5 "Depreciation of domestic currency"

Results: The Element "Foreign exchange rate" has an active sum of 2 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Foreign exchange rate" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Foreign exchange rate".

Element 28: Money supply

Relevance: Action 1-1 “Extension of money supply”

Results: The Element “Money supply” has an active sum of 11 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element “Money supply” is an active element.

Interpretation: Changes in the system may be initiated by the active Element “Money supply”.

Summary of results

The analysis of systemic roles of elements shows that the power of each element to change the system behaviour is independent of specific ambitions of curbing the spread of a financial crisis. Chapter 3.3.3 explains the background of this technique. Table 5-3 summarises the results for each identified action, including the linked element and the classification as active, critical, passive and buffering.

The majority of actions are categorised as passive or buffering and, hence, they are not qualified to initiate actions according to the interpretation scheme of Ulrich and Probst (1991) and Vester (2007). The actions “Extension of money supply” [#1-1], “Increasing of general interest rate” [#1-2], “Decreasing of general interest rate” [#1-3] and “Debt moratoria for financed investors” [#3-4] seem strong enough to change the system behaviour without risking an over-regulation, which might be the case for the action “Bank holidays on exchanges” [#3-7].

Table 5-3: Summary of systemic roles of elements for identified actions

#	Action	Element	Active	Critical	Passive	Buffering
1-1	Extension of money supply	28: Money supply	Yes	No	No	No
1-2	Increasing of general interest rate	9: General rate of interest	Yes	No	No	No
1-3	Decreasing of general interest rate	9: General rate of interest	Yes	No	No	No
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No	No	No	Yes
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No	No	No	Yes
1-6	Asset purchases from markets	1: Asset demand	No	No	Yes	No
1-7	Asset purchases from banks	19: Liquidity of banks	No	No	Yes	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No	No	No	Yes
2-1	Provision of liquidity to banks	19: Liquidity of banks	No	No	Yes	No
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No	No	No	Yes
2-3	Provision of foreign liquidity	19: Liquidity of banks	No	No	Yes	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	No	No	No	Yes
3-2	Asset purchase programme	19: Liquidity of banks	No	No	Yes	No
3-3	Asset transfer programme	24: Creditworthiness of banks	No	No	No	Yes
3-4	Debt moratoria for financed investors	18: Payments for loans	Yes	No	No	No
3-5	Accounting discretion	24: Creditworthiness of banks	No	No	No	Yes
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	No	Yes	No
3-7	Bank holidays on exchanges	3: Asset price	No	Yes	No	No
3-8	Stress tests	25: Uncertainty	No	No	No	Yes
3-9	Prohibition of short sales	21: Short sales	No	No	No	Yes

This section analysed the strength of already known actions. The next pages focus on potential new actions.

5.2.2 Analysis of potential new actions

Element 2: Asset supply

Results: The Element "Asset supply" has an active sum of 3 and a passive sum of 7. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Asset supply" is a passive element.

Interpretation: Changes in the system should not be initiated by the passive Element "Asset supply".

Element 4: Expected risk of asset

Results: The Element "Expected risk of asset" has an active sum of 2 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Expected risk of asset" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Expected risk of asset".

Element 5: Expected return of asset

Results: The Element "Expected return of asset" has an active sum of 6 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Expected return of asset" is an active element.

Interpretation: Changes in the system may be initiated by the active Element "Expected return of asset".

Element 6: Asset risk-return ratio

Results: The Element "Asset risk-return ratio" has an active sum of 2 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Asset risk-return ratio" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Asset risk-return ratio".

Element 7: Market risk-return ratio

Results: The Element "Market risk-return ratio" has an active sum of 2 and a passive sum of 6. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Market risk-return ratio" is a passive element.

Interpretation: Changes in the system should not be initiated by the passive Element "Market risk-return ratio".

Element 8: Attractiveness of asset

Results: The Element "Attractiveness of asset" has an active sum of 4 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Attractiveness of asset" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Attractiveness of asset".

Element 10: Costs of new loans

Results: The Element "Costs of new loans" has an active sum of 4 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Costs of new loans" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Costs of new loans".

Element 11: Attractiveness of financed investments

Results: The Element "Attractiveness of financed investments" has an active sum of 2 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Attractiveness of financed investments" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Attractiveness of financed investments".

Element 12: New loans for investments

Results: The Element "New loans for investments" has an active sum of 8 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "New loans for investments" is an active element.

Interpretation: Changes in the system may be initiated by the active Element "New loans for investments".

Element 13: Creditworthiness of financed investors

Results: The Element "Creditworthiness of financed investors" has an active sum of 2 and a passive sum of 6. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Creditworthiness of financed investors" is a passive element.

Interpretation: Changes in the system should not be initiated by the passive Element "Creditworthiness of financed investors".

Element 14: Payments for new loans

Results: The Element "Payments for new loans" has an active sum of 2 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Payments for new loans" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Payments for new loans".

Element 15: Risk of debt default

Results: The Element "Risk of debt default" has an active sum of 5 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Risk of debt default" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Risk of debt default".

Element 16: Loans for investments

Results: The Element "Loans for investments" has an active sum of 2 and a passive sum of 4. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Loans for investments" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Loans for investments".

Element 20: Euphoria

Results: The Element "Euphoria" has an active sum of 4 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Euphoria" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Euphoria".

Element 22: Risk of misbehaviour

Results: The Element "Risk of misbehaviour" has an active sum of 4 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Risk of misbehaviour" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Risk of misbehaviour".

Element 23: Risk of contagion

Results: The Element "Risk of contagion" has an active sum of 6 and a passive sum of 5. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Risk of contagion" is an active element.

Interpretation: Changes in the system may be initiated by the active Element "Risk of contagion".

Element 26: Interbank lending

Results: The Element "Interbank lending" has an active sum of 4 and a passive sum of 2. The respective threshold of the four-field-matrix is 5.5. According to the interpretation scheme of Ulrich and Probst (1991) the Element "Interbank lending" is a buffering element.

Interpretation: Changes in the system should not be initiated by the buffering Element "Interbank lending".

Summary of results

The analysis of systemic roles of elements shows that the power of each element to change the system behaviour is independent of specific ambitions of curbing a financial crisis. Chapter 3.3.3 explains the background of this technique. Table 5-4 summarises for each potential new action the results, including the classification as active, critical, passive and buffering.

The majority of elements are categorised as passive or buffering; hence, they are not qualified to initiate actions according to the interpretation scheme of Ulrich and Probst (1991) and Vester (2007). The potential new actions "Increasing of decreasing of expected return of asset", "Increasing of decreasing of new loans for investments", "Increasing of payments for loans", "Increasing of decreasing of risk of contagion" and "Decreasing of

money supply" seem strong enough to change the system behaviour without risking an over-regulation.

Table 5-4: Summary of systemic roles for potential new actions

#	Potential new action	Active	Critical	Passive	Buffering
1[21]	Decreasing of asset demand	No	No	Yes	No
2	Increasing or decreasing of asset supply	No	No	Yes	No
4	Increasing or decreasing of expected risk of asset	No	No	No	Yes
5	Increasing or decreasing of expected return of asset	Yes	No	No	No
6	Increasing or decreasing of asset risk-return ratio	No	No	No	Yes
7	Increasing or decreasing of market risk-return ratio	No	No	Yes	No
8	Increasing or decreasing of attractiveness of asset	No	No	No	Yes
10	Increasing or decreasing of costs of new loans	No	No	No	Yes
11	Increasing or decreasing of attractiveness of financed investments	No	No	No	Yes
12	Increasing or decreasing of new loans for investments	Yes	No	No	No
13	Increasing or decreasing of creditworthiness of financed investors	No	No	Yes	No
14	Increasing or decreasing of payments for new loans	No	No	No	Yes
15	Increasing or decreasing of risk of debt default	No	No	No	Yes
16	Increasing or decreasing of loans for investments	No	No	No	Yes
17[21]	Decreasing of asset cash flow	No	No	No	Yes
18[21]	Increasing of payments for loans	Yes	No	No	No
19[21]	Decreasing of liquidity of banks	No	No	Yes	No
20	Increasing or decreasing of euphoria	No	No	No	Yes
21[21]	Increasing of short sales	No	No	No	Yes
22	Increasing or decreasing of risk of misbehaviour	No	No	No	Yes
23	Increasing or decreasing of risk of contagion	Yes	No	No	No
24[21]	Decreasing of creditworthiness of banks	No	No	No	Yes

[21] Data based on analyses of the previous section

#	Potential new action	Active	Critical	Passive	Buffering
25[21]	Increasing of uncertainty	No	No	No	Yes
26	Increasing or decreasing of interbank lending	No	No	No	Yes
28[21]	Decreasing of money supply	Yes	No	No	No

The last two sections identified powerful actions. The next analysis, which is dealt with in the next section, focuses on the effects of actions during financial crises.

5.3 Impact of actions

This section shows the impact of actions to the three key elements of the system. For each element, the quantity of positive and negative paths are counted and their lengths are analysed (the details of the method are described in Chapter 3.3.4). The impact analysis is applied for each element thrice. All direct and indirect interrelations from the relevant element to one of the three key elements are separately documented. The documentation also includes the analysis of the involvement of the systems' elements in positive and negative paths. All results are interpreted. The first section contains identified actions and the second sections deal with potential new actions. A summary of this analysis is documented on page 280 for identified actions and on page 411 for potential new actions.

5.3.1 Analysis of identified actions

Paths from Element 1 (Asset demand) to Element 3 (Asset price)

Relevance: Action 1-6 "Asset purchases from markets"

Results: The initial impulse of an increase of the Element "Asset demand" leads to an increase of the Element "Asset price" in 6 cases. In 6 cases the initial impulse of an increase of the Element "Asset demand" leads to a decrease of the Element "Asset price". For a detailed list of paths please refer to Appendix 4.

Positive paths are shorter than negative paths. The mean is 10.5 for positive paths and 13.5 for negative paths. The median is 12.0 for positive paths and 14.0 for negative paths. The spread of the lengths of positive paths is greater. For a detailed list of numbers please refer to Appendix 5.

Next to other elements, the Element "Risk of contagion" is directly related and, therefore, more often involved in paths from Element 1 to Element 3. Elements are equally involved in positive and negative paths. Figure 5-53 shows the distribution of the elements' involvement in the paths. For a detailed list of numbers please refer to Appendix 6.

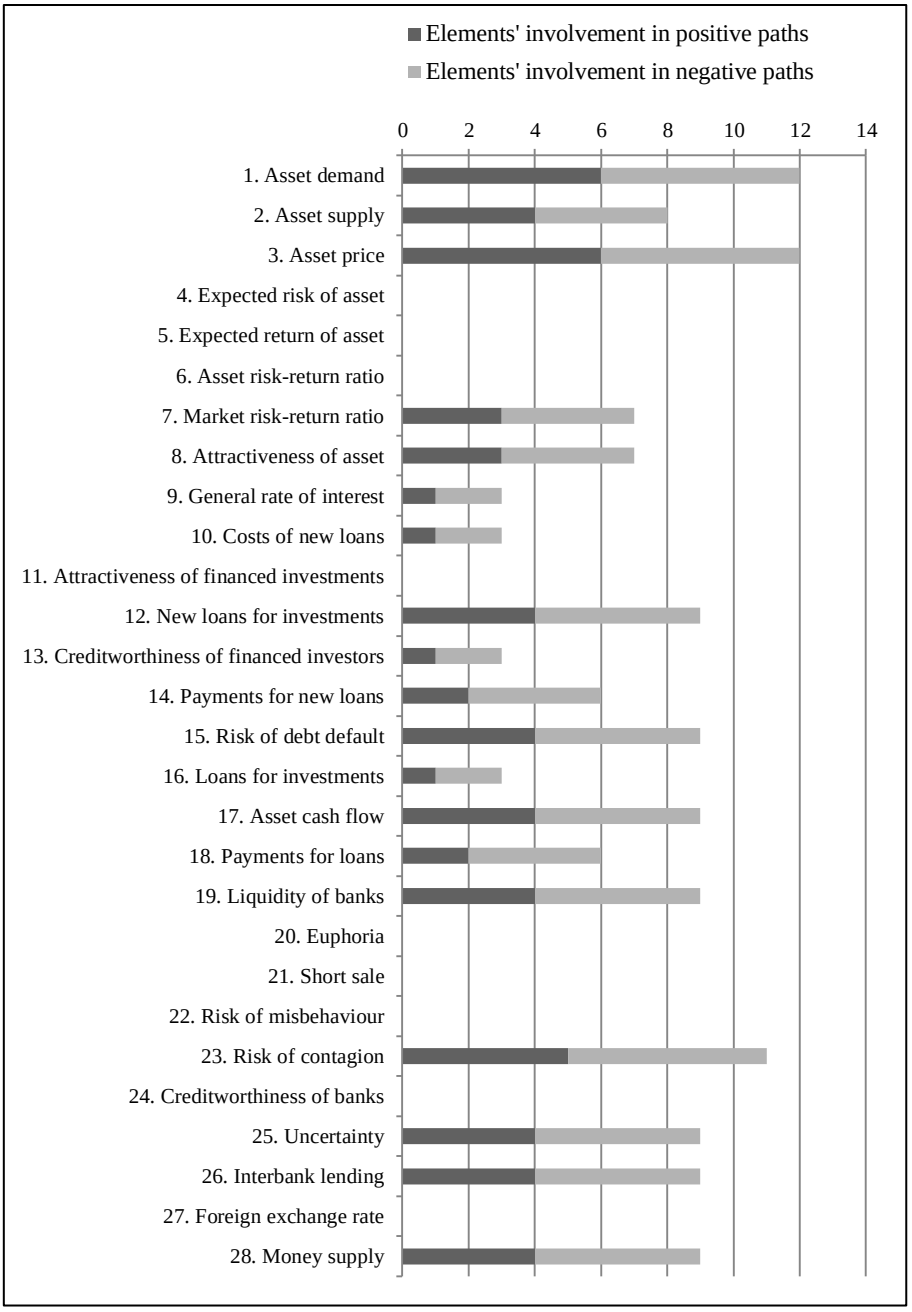


Figure 5-53: Involvement of elements in paths from Element 1 to Element 3 (from Element "Asset demand" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Asset demand" neither increases nor decreases the Element "Asset price" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that an initial impulse of increasing the Element "Asset demand" slightly increases the Element

"Asset price".

Paths from Element 1 (Asset demand) to Element 19 (Liquidity of banks)

Relevance: Action 1-6 "Asset purchases from markets"

Results: The initial impulse of an increase of the Element "Asset demand" leads to an increase of the Element "Liquidity of banks" in 118 cases. In 123 cases the initial impulse of an increase of the Element "Asset demand" leads to a decrease of the Element "Liquidity of banks". 2.1% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.5 for positive paths and 14.6 for negative paths. The median is 15.0 for positive paths and 14.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-54 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

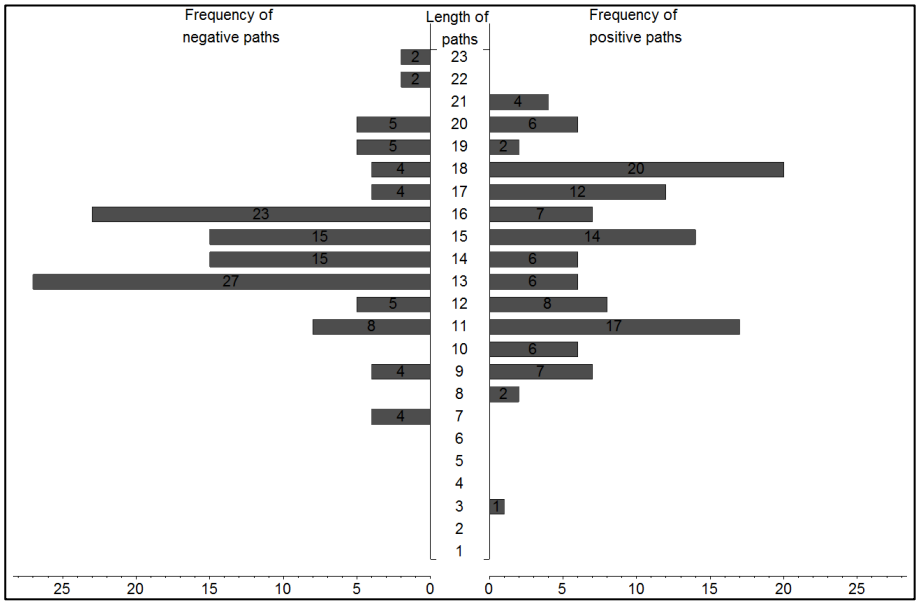


Figure 5-54: Length of paths from Element 1 to Element 19 (from Element "Asset demand" to Element "Liquidity of banks")

Next to other elements, the Element "Asset price" is directly related and, therefore, more often involved in paths from Element 1 to Element 19. Indirectly, the Elements "Risk of debt default" and "Asset cash flow"

play significant roles. Elements are equally involved in positive and negative paths. Figure 5-55 shows the respective distribution of the elements' involvement in positive and negative paths. For a detailed list of numbers please refer to Appendix 6.

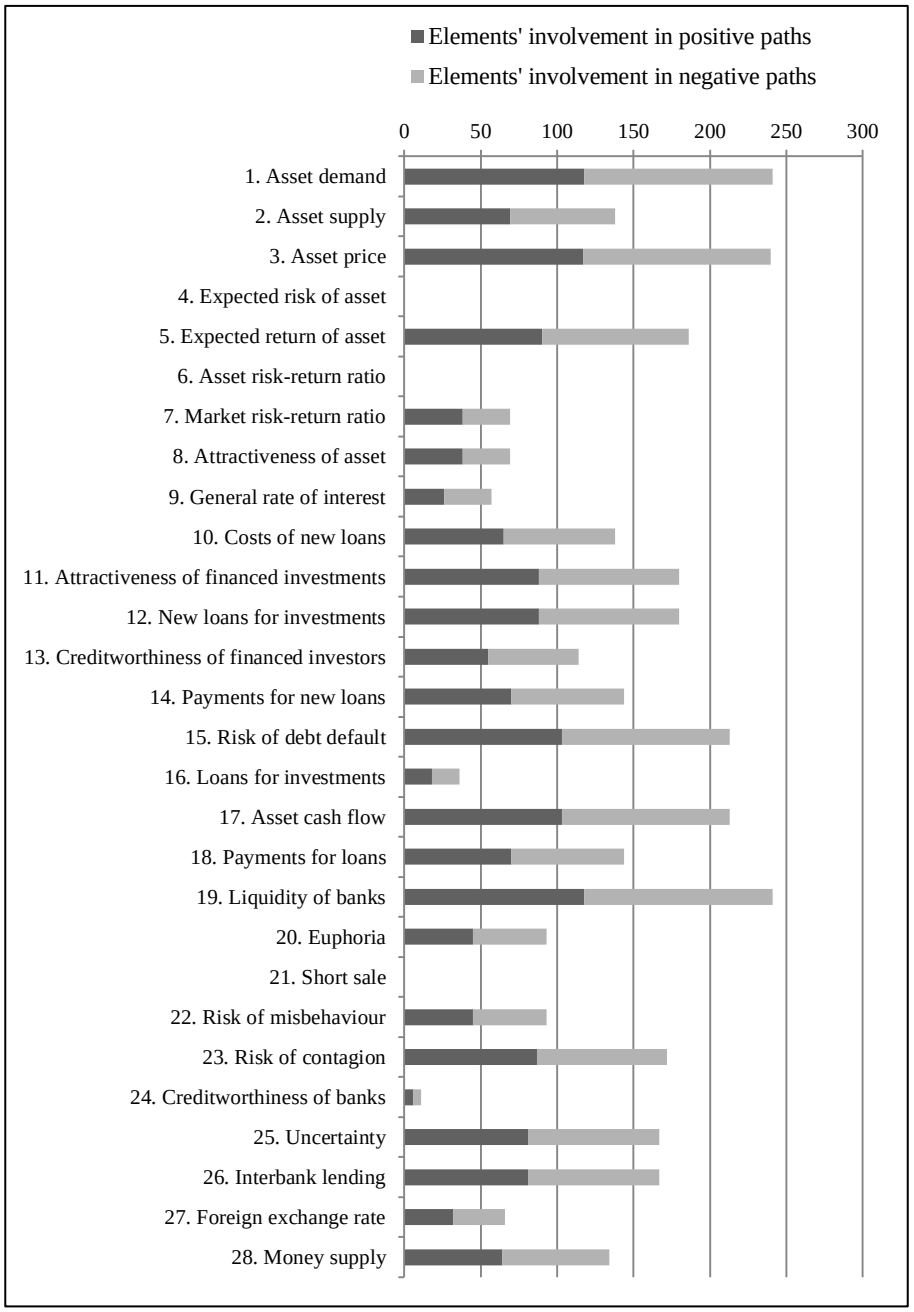


Figure 5-55: Involvement of elements in paths from Element 1 to Element 19 (from Element "Asset demand" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Asset demand" slightly decreases the Element "Liquidity of banks".

Paths from Element 1 (Asset demand) to Element 27 (Foreign exchange rate)

Relevance: Action 1-6 "Asset purchases from markets"

Results: The initial impulse of an increase of the Element "Asset demand" leads to an increase of the Element "Foreign exchange rate" in 40 cases. In 38 cases the initial impulse of an increase of the Element "Asset demand" leads to a decrease of the Element "Foreign exchange rate" 2.6% more positive paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 16.1 for positive paths and 14.8 for negative paths. The median is 16.0 for positive paths and 14.0 for negative paths. The spread of the lengths is higher for negative paths. Figure 5-56 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

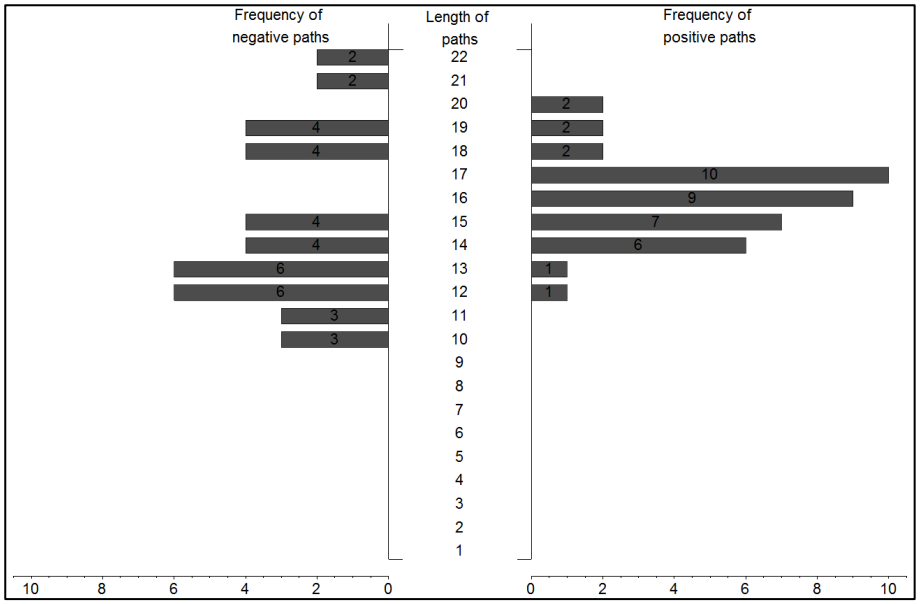


Figure 5-56: Length of paths from Element 1 to Element 27 (from Element "Asset demand" to Element "Foreign exchange rate")

Next to other elements, the Element "Asset price" is directly related and, therefore, more often involved in paths from Element 1 to Element 27. Indirectly, the Elements "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant

roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Costs of new loans", "New loans for investments", "Creditworthiness of financed investors", "Payments for new loans" and "Payments for loans" are more often involved in positive paths. Figure 5-57 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

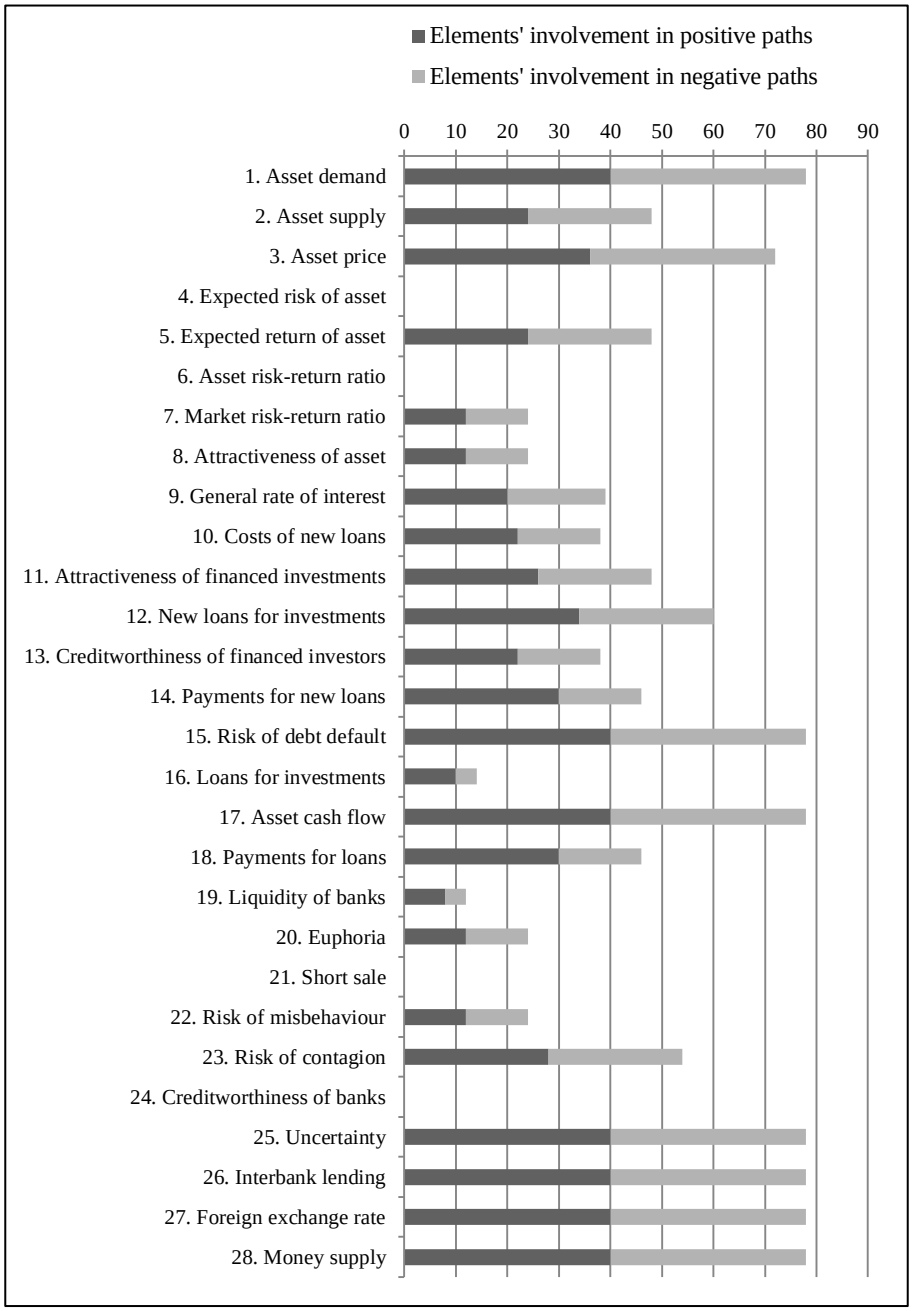


Figure 5-57: Involvement of elements in paths from Element 1 to Element 27 (from Element "Asset demand" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Asset demand" slightly increases the Element "Foreign exchange rate".

Paths from Element 3 (Asset price) to Element 19 (Liquidity of banks)

Relevance: Action 3-7 "Bank holidays on exchanges"

Results: The initial impulse of relatively increased prices leads to an increase of the Element "Liquidity of banks" in 69 cases. In 67 cases the initial impulse of a relatively increase of the Element "Asset price" leads to a decrease of the Element "Liquidity of banks". 1.5% more positive paths exist compared to negative paths. However, the initial impulse stops only further price drops, which do not lead to more loss of the Element "Liquidity of banks". For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 12.2 for positive paths and 12.5 for negative paths. The median is 11.0 for positive paths and 12.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. Figure 5-58 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

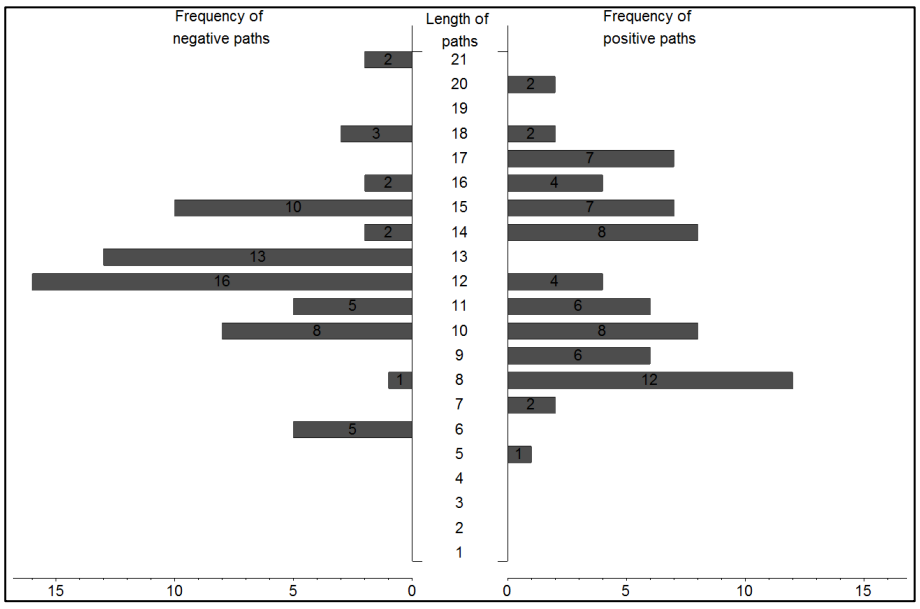


Figure 5-58: Length of paths from Element 3 to Element 19 (from Element "Asset price" to Element "Liquidity of banks")

Indirectly, the Elements “Risk of debt default” and “Asset cash flow” play significant roles in paths from Element 3 to Element 19. In general, elements are equally involved in positive and negative paths. However, there are two significant exceptions. The Elements “Asset demand“ and “Risk of contagion” are more often involved in positive paths. Figure 5-59 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

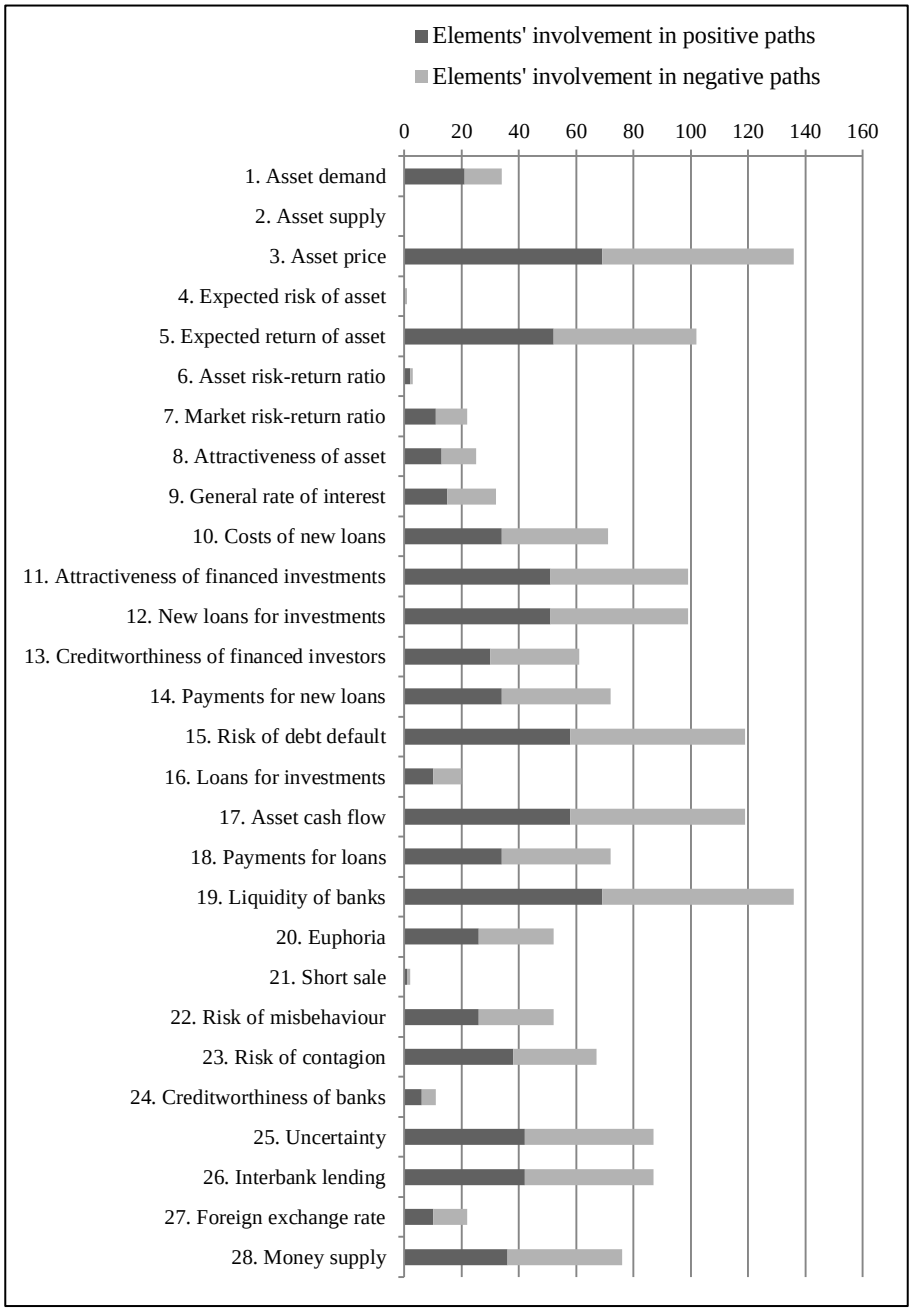


Figure 5-59: Involvement of elements in paths from Element 3 to Element 19 (from Element “Asset price” to Element “Liquidity of banks”)

Interpretation: The initial impulse of fixing fallen prices slightly stops the downturn of the Element "Liquidity of banks".

Paths from Element 3 (Asset price) to Element 27 (Foreign exchange rate)

Relevance: Action 3-7 "Bank holidays on exchanges"

Results: The initial impulse of a relatively increase of prices leads to an increase of the Element "Foreign exchange rate" in 28 cases. In 26 cases the initial impulse of a relatively increase of the Element "Asset price" leads to a decrease of the Element "Foreign exchange rate" 3.7% more positive paths exist compared to negative paths. However, the initial impulse stops only further price drops, which do not lead to further drops of the Element "Foreign exchange rate" For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 16.0 for positive paths and 13.9 for negative paths. The median is 16.0 for positive paths and 12.5 for negative paths. The spread of the lengths is higher for negative paths. Figure 5-60 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

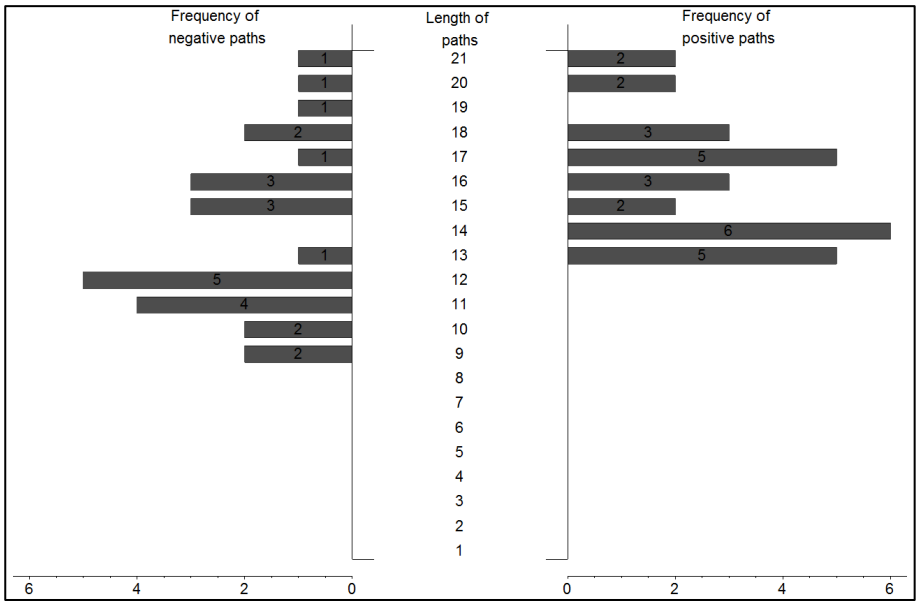


Figure 5-60: Length of paths from Element 3 to Element 27 (from Element "Asset price" to Element "Foreign exchange rate")

Indirectly, the Elements “New loans for investments”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles in paths from Element 3 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “New loans for investments”, “Payments for new loans”, “Payments for loans” and “Liquidity of bank” are more often involved in positive paths. Figure 5-61 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

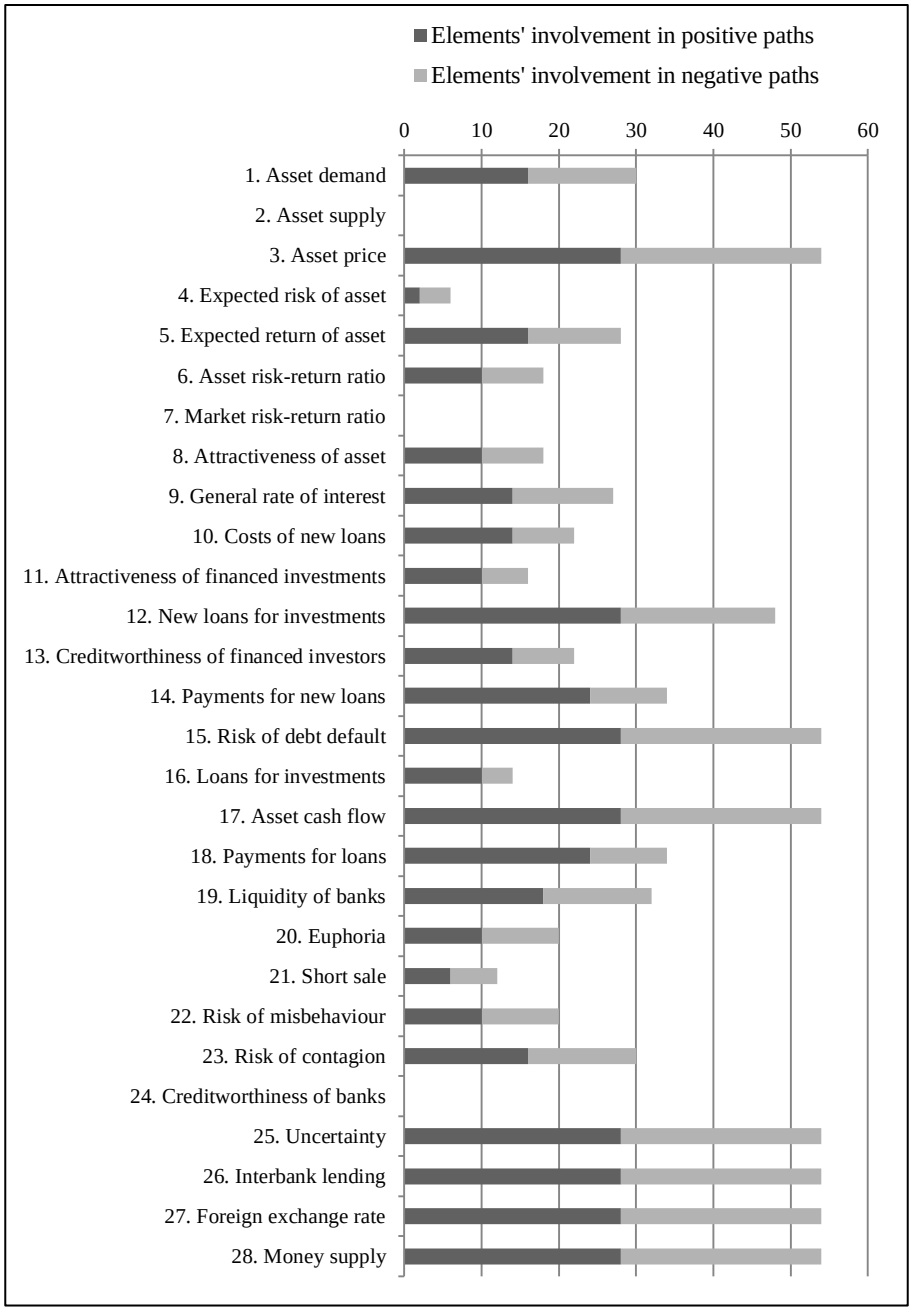


Figure 5-61: Involvement of elements in paths from Element 3 to Element 27 (from Element "Asset price" to Element "Foreign exchange rate")

Interpretation: The initial impulse of fixing fallen prices slightly stops the downturn of the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of negative paths are shorter than those of positive paths, which intensify the effects of negative paths. Therefore, it is assumed that fixing fallen prices neither increases nor decreases the Element "Foreign exchange rate".

Paths from Element 9 (General rate of interest) to Element 3 (Asset price)

Relevance: Action 1-2 "Increasing of general interest rate"
Action 1-3 "Decreasing of general interest rate"

Results: The initial impulse of an increase of the Element "General rate of interest" leads to an increase of the Element "Asset price" in 78 cases. In 79 cases the initial impulse of an increase of the Element "General rate of interest" leads to a decrease of the Element "Asset price".
The initial impulse of a decrease of the Element "General rate of interest" leads to a decrease of the Element "Asset price" in 78 cases. In 79 cases the initial impulse of a decrease of the Element "General rate of interest" leads to an increase of the Element "Asset price".
0.6% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 13.7 for positive paths and 13.1 for negative paths. The median is 14.0 for positive paths and 13.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. Figure 5-62 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

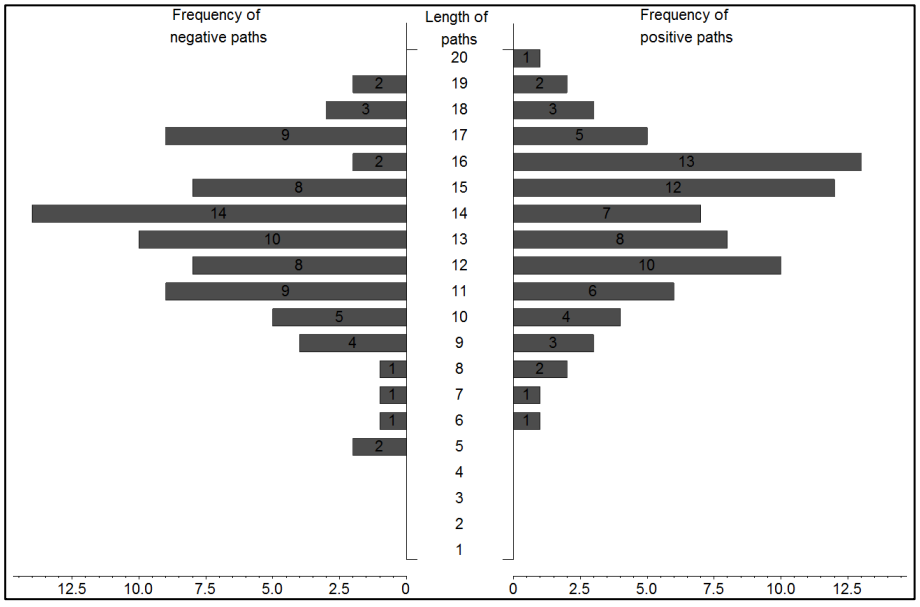


Figure 5-62: Length of paths from Element 9 to Element 3 (from Element "General rate of interest" to Element "Asset price")

Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles in paths from Element 9 to Element 3. Elements are equally involved in positive and negative paths. Figure 5-63 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

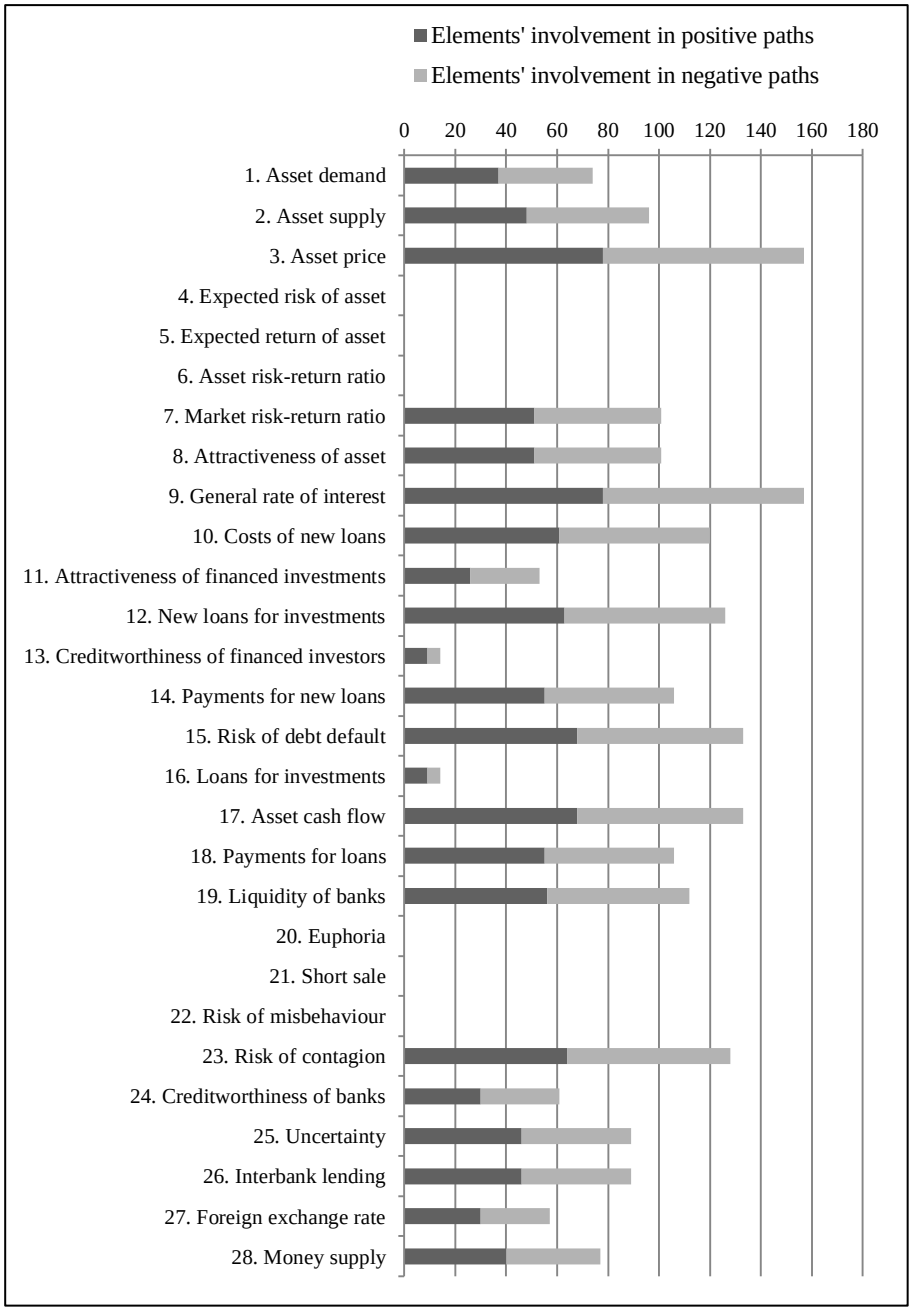


Figure 5-63: Involvement of elements in paths from Element 9 to Element 3 (from Element "General rate of interest" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "General rate of interest" slightly decreases the Element "Asset price".

The initial impulse of decreasing the Element "General rate of interest" slightly increases the Element "Asset price".

Paths from Element 9 (General rate of interest) to Element 19 (Liquidity of banks)

Relevance: Action 1-2 "Increasing of general interest rate"

Action 1-3 "Decreasing of general interest rate"

Results: The initial impulse of an increase of the Element "General rate of interest" leads to an increase of the Element "Liquidity of banks" in 156 cases. In 169 cases the initial impulse of an increase of the Element "General rate of interest" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "General rate of interest" leads to a decrease of the Element "Liquidity of banks" in 156 cases. In 169 cases the initial impulse of a decrease of the Element "General rate of interest" leads to an increase of the Element "Liquidity of banks".

4.0% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.6 for positive paths and 15.0 for negative paths. The median is 16.0 for positive paths and 15.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-64 shows the respective histograms. For a detailed list of numbers please refer Appendix 5.

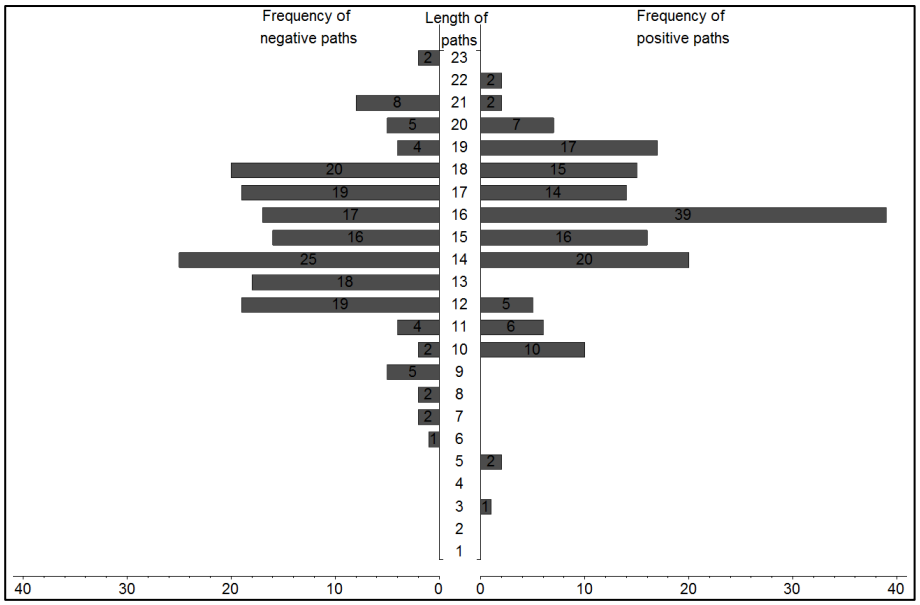


Figure 5-64: Length of paths from Element 9 to Element 19 (from Element "General rate of interest" to Element "Liquidity of banks")

Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles in paths from Element 9 to Element 19. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Loans for investments" and "Foreign exchange rate" are more often involved in positive paths. The Element "Creditworthiness of banks" is more often involved in negative paths. Figure 5-65 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

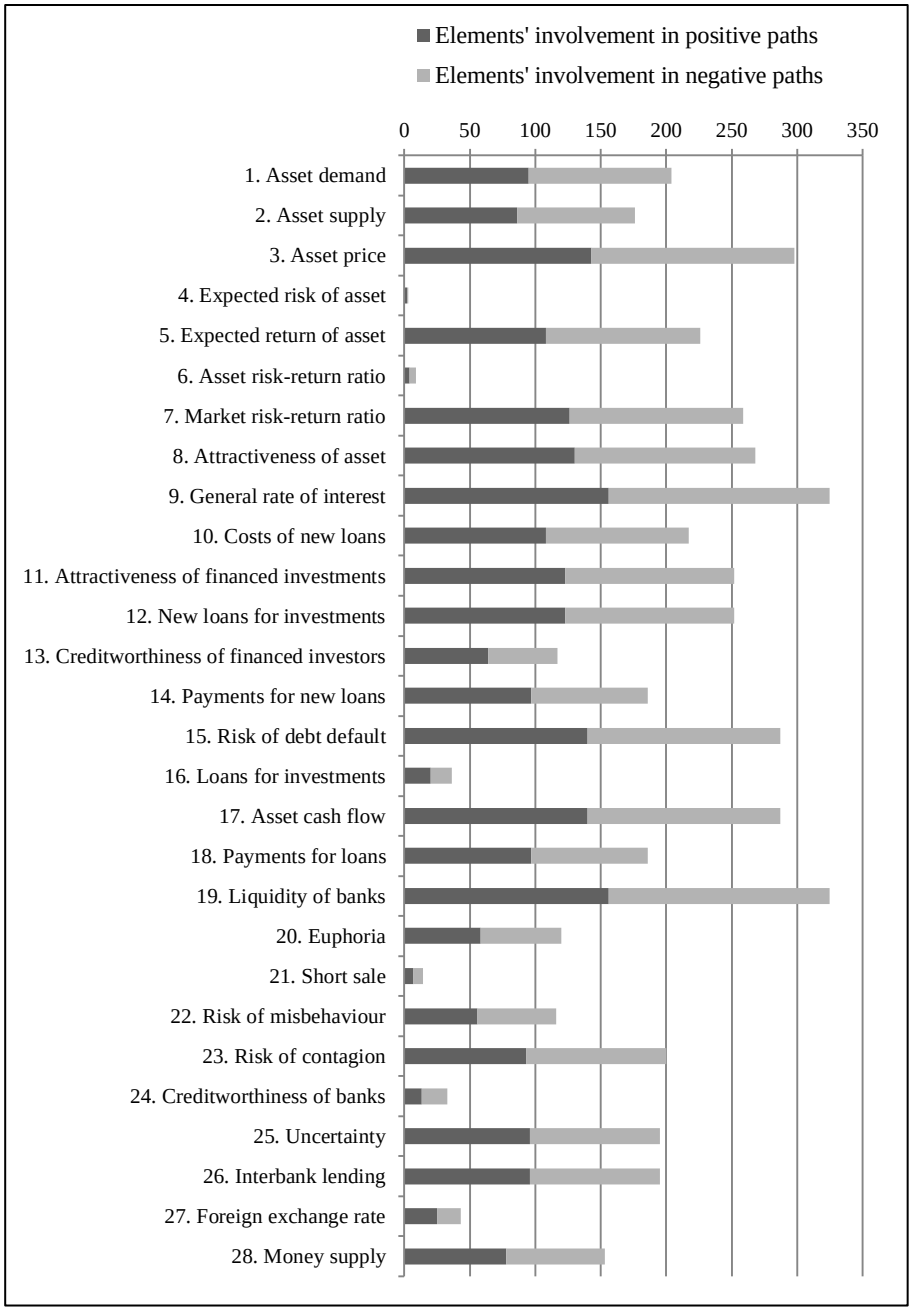


Figure 5-65: Involvement of elements in paths from Element 9 to Element 19 (from Element "General rate of interest" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "General rate of interest" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "General rate of interest" slightly increases the Element "Liquidity of banks".

Paths from Element 9 (General rate of interest) to Element 27 (Foreign exchange rate)

Relevance: Action 1-2 "Increasing of general interest rate"
Action 1-3 "Decreasing of general interest rate"

Results: The initial impulse of an increase of the Element "General rate of interest" leads to an increase of the Element "Foreign exchange rate" in 45 cases. In 41 cases the initial impulse of an increase of the Element "General rate of interest" leads to a decrease of the Element "Foreign exchange rate".
The initial impulse of a decrease of the Element "General rate of interest" leads to a decrease of the Element "Foreign exchange rate" in 45 cases. In 41 cases the initial impulse of a decrease of the Element "General rate of interest" leads to an increase of the Element "Foreign exchange rate".
4.7% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 16.4 for positive paths and 18.1 for negative paths. The median is 16.0 for positive paths and 18.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-66 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

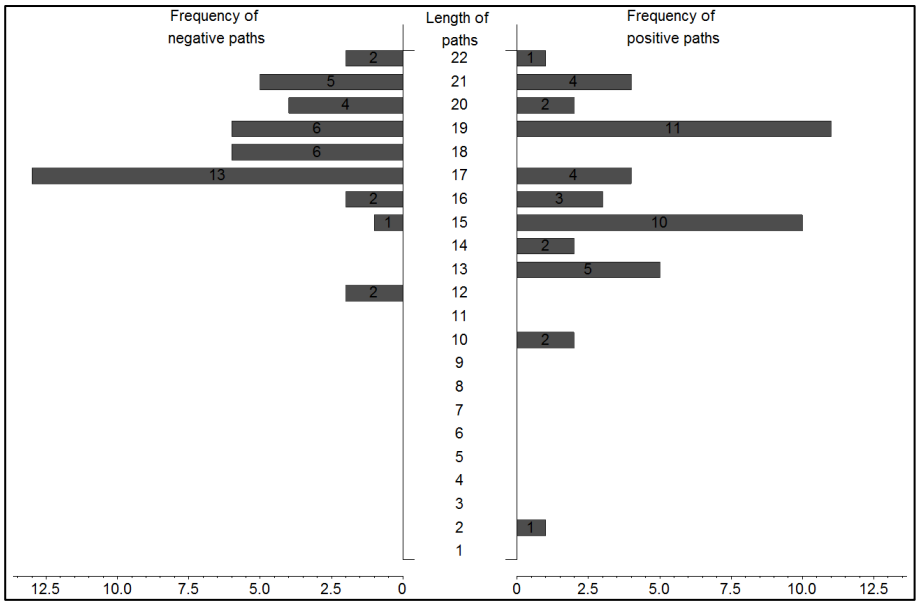


Figure 5-66: Length of paths from Element 9 to Element 27 (from Element "General rate of interest" to Element "Foreign exchange rate")

Indirectly, the Elements Asset price", New loan for investments", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles in paths from Element 9 to Element 27. In general, elements are equally involved in positive and negative paths. There are several exceptions. The Elements "Market risk-return ratio" and "Attractiveness of asset" are more often involved in positive paths. The Elements "New loans for investments", "Payments for new loans" and "Payments for loans" are more often involved in negative paths. Figure 5-67 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

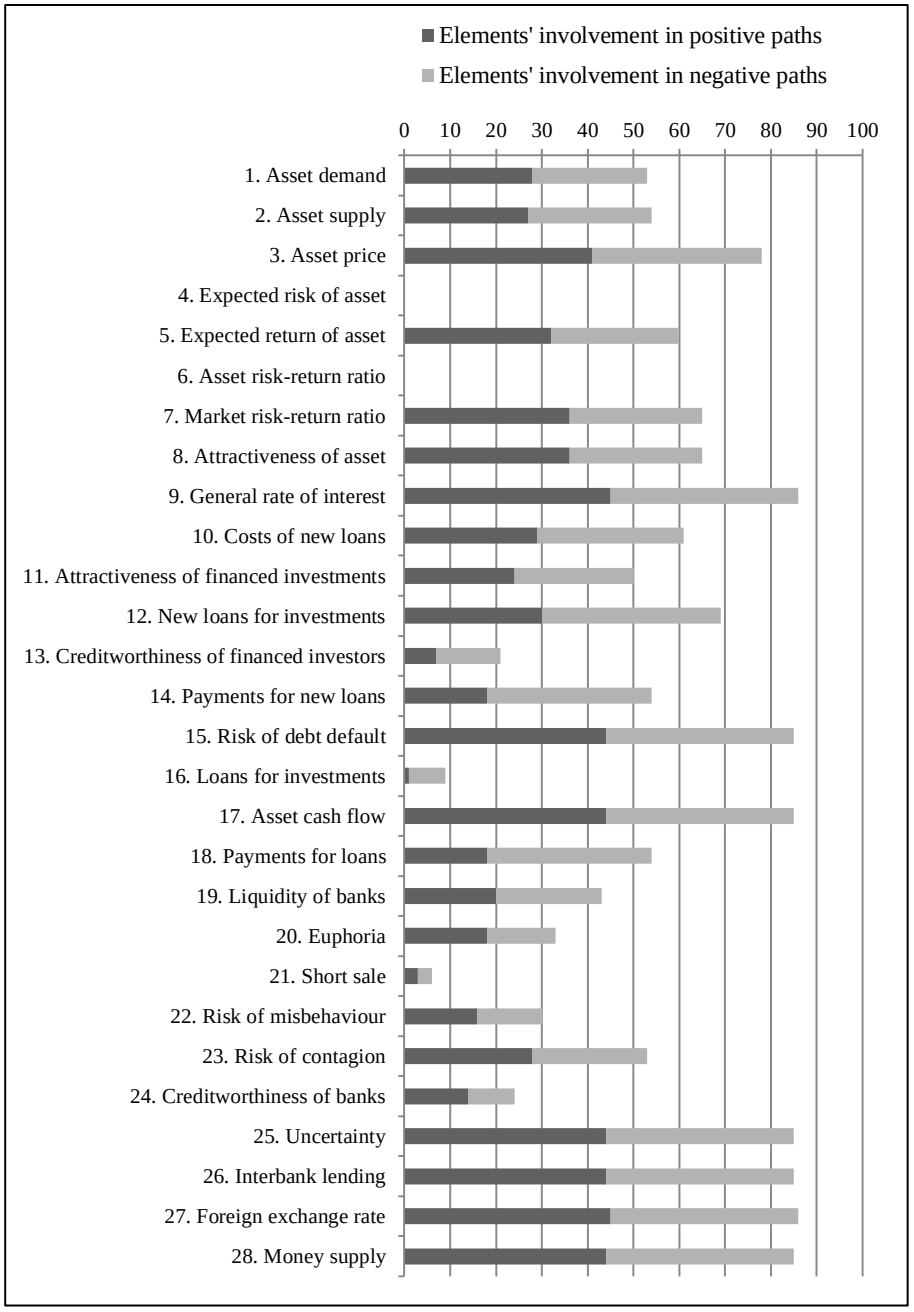


Figure 5-67: Involvement of elements in paths from Element 9 to Element 27 (from Element "General rate of interest" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "General rate of interest" slightly increases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "General rate of interest" slightly reduces the Element "Foreign exchange rate".

Paths from Element 17 (Asset cash flow) to Element 3 (Asset price)

Relevance: Action 2-2 "Provision of liquidity to financed investors"

Results: The initial impulse of an increase of the Element "Asset cash flow" leads to an increase of the Element "Asset price" in 38 cases. In 35 cases the initial impulse of an increase of the Element "Asset cash flow" leads to a decrease of the Element "Asset price" 4.1% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 11.6 for positive paths and 11.7 for negative paths. The median is 12.5 for positive paths and 12.0 for negative paths. The spreads of the lengths are almost identical for positive and negative paths. Figure 5-68 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

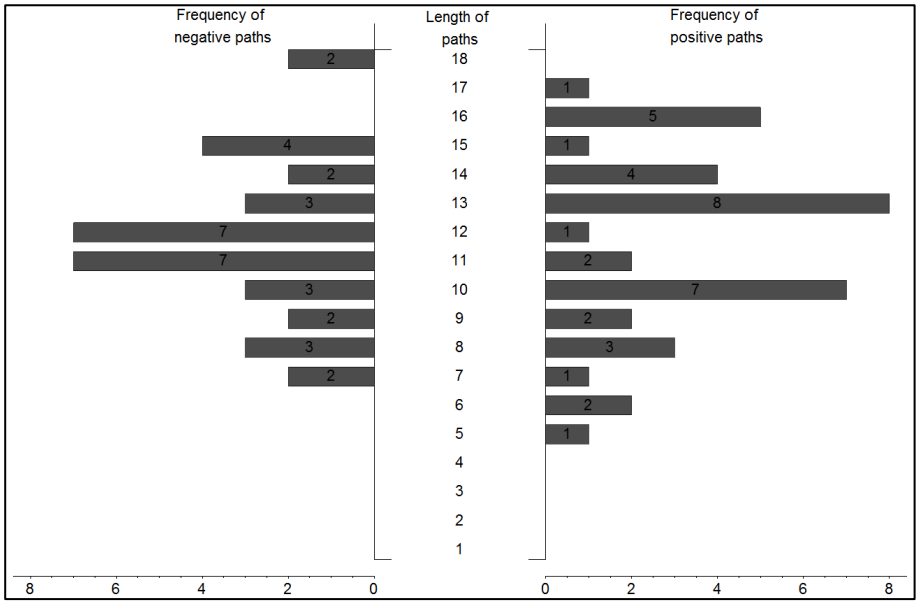


Figure 5-68: Length of paths from Element 17 to Element 3 (from Element "Asset cash flow" to Element "Asset price")

The Element "Risk of debt default" is directly related and, therefore, more often involved in paths from Element 17 to Element 3. Indirectly, the Element "Risk of contagion" plays significant roles. Elements are equally involved in positive and negative paths. Figure 5-69 shows the

respective distribution. For a detailed list of numbers please refer to Appendix 6.

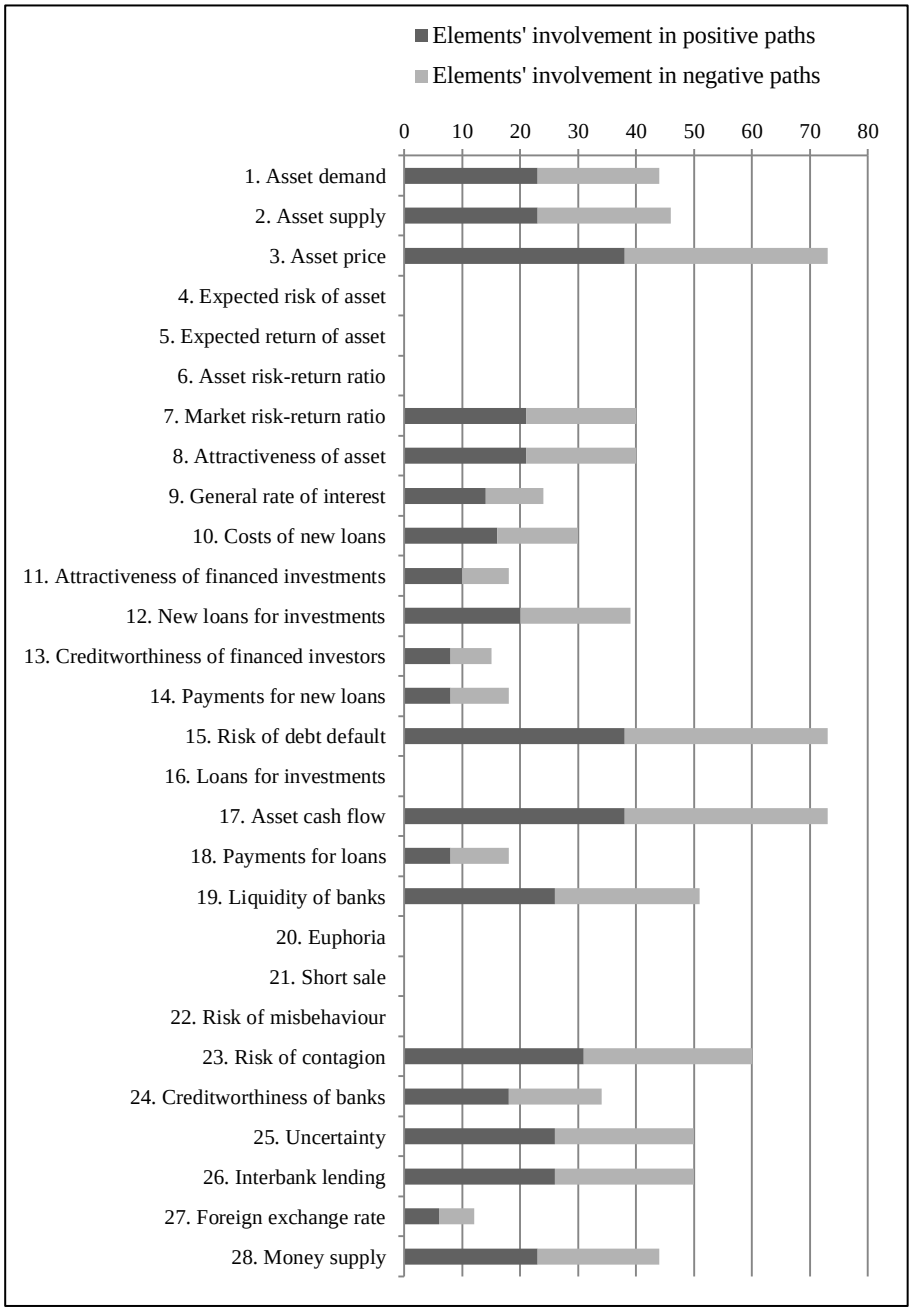


Figure 5-69: Involvement of elements in paths from Element 17 to Element 3 (from Element "Asset cash flow" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Asset cash flow" slightly increases the Element "Asset price".

Paths from Element 17 (Asset cash flow) to Element 19 (Liquidity of banks)

Relevance: Action 2-2 "Provision of liquidity to financed investors"

Results: The initial impulse of an increase of the Element "Asset cash flow" leads to an increase of the Element "Liquidity of banks" in 92 cases. In 87 cases the initial impulse of an increase of the Element "Asset cash flow" leads to a decrease of the Element "Liquidity of banks". 2.8% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter positive paths are equalised by longer positive paths. The mean is 14.4 for positive paths and 14.5 for negative paths. The median is 14.0 for positive paths and 15.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-70 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

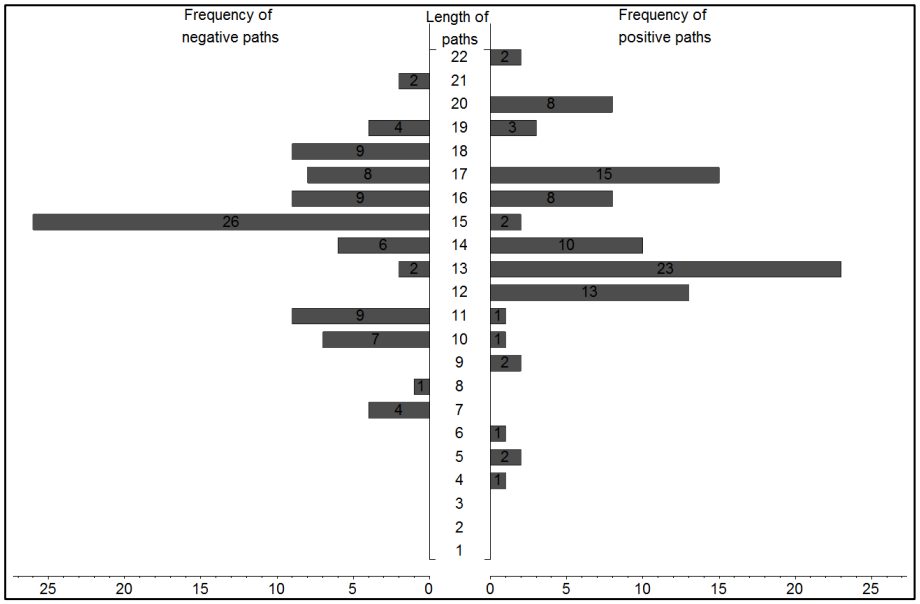


Figure 5-70: Length of paths from Element 17 to Element 19 (from Element "Asset cash flow" to Element "Liquidity of banks")

The Element "Risk of debt default" is directly related and, therefore, more often involved in paths from Element 17 to Element 19. Indirectly, the Elements "Asset price", Attractiveness of financed investments" and New loans for investments" play significant roles In general, elements

are equally involved in positive and negative paths. However, there is one significant exception. The Element "General rate of interest" is more often involved in positive paths. Figure 5-71 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

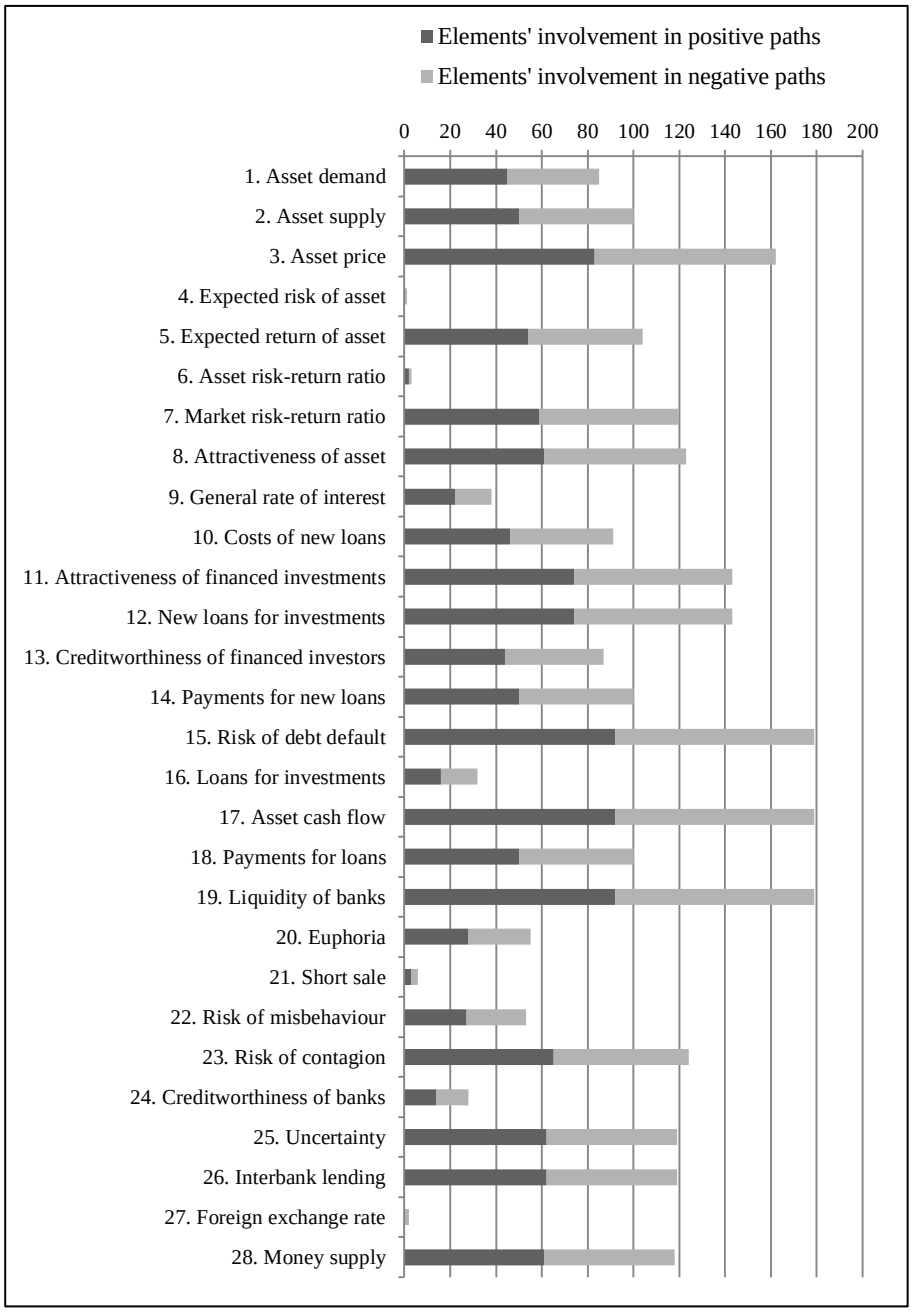


Figure 5-71: Involvement of elements in paths from Element 17 to Element 19 (from Element "Asset cash flow" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Asset cash flow" slightly increases the Element "Liquidity of banks".

Paths from Element 17 (Asset cash flow) to Element 27 (Foreign exchange rate)

Relevance: Action 2-2 "Provision of liquidity to financed investors"

Results: The initial impulse of an increase of the Element "Asset cash flow" leads to an increase of the Element "Foreign exchange rate" in 0 cases. In 2 cases the initial impulse of an increase of the Element "Asset cash flow" leads to a decrease of the Element "Foreign exchange rate". For a detailed list of paths please refer to Appendix 4.

Affected elements are exclusively involved either in positive or negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Asset cash flow" reduces the Element "Foreign exchange rate".

Paths from Element 18 (Payments for loans) to Element 3 (Asset price)

Relevance: Action 3-4 "Debt moratoria for financed investors"

Results: The initial impulse of a decrease of the Element "Payments for loans" leads to a decrease of the Element "Asset price" in 54 cases. In 57 cases the initial impulse of a decrease of the Element "Payments for loans" leads to an increase of the Element "Asset price" 2.7% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 12.5 for both. The median is 13.0 for positive paths and 12.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-72 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

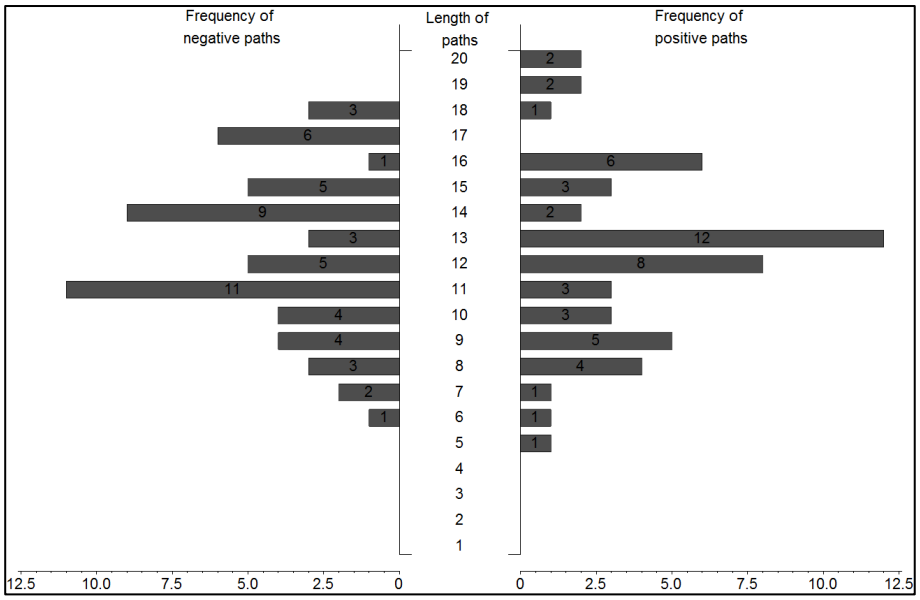


Figure 5-72: Length of paths from Element 18 to Element 3 (from Element "Payments for loans" to Element "Asset price")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 18 to Element 3. Indirectly, the Elements "Risk of debt default" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-73 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

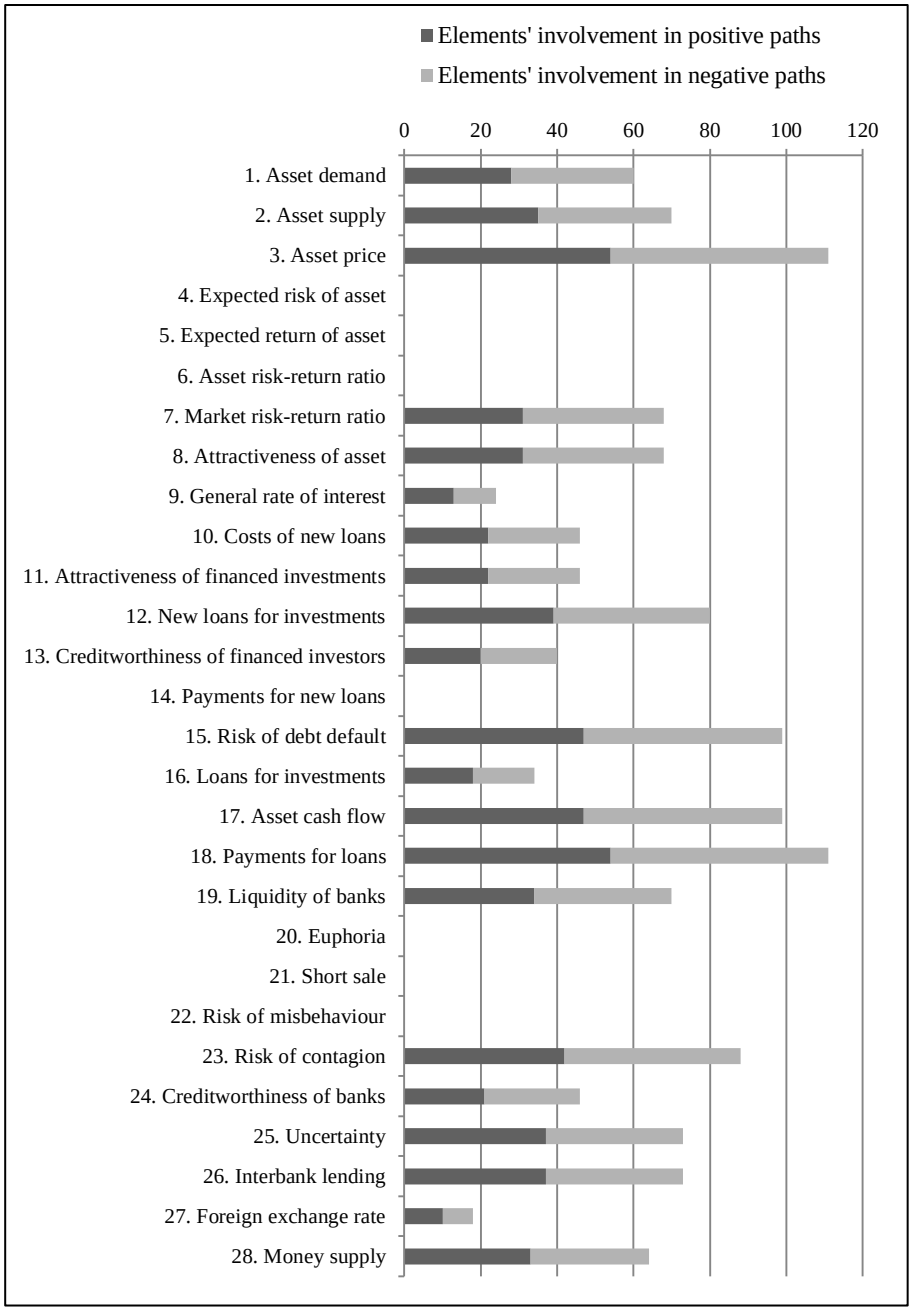


Figure 5-73: Involvement of elements in paths from Element 18 to Element 3 (from Element "Payments for loans" to Element "Asset price")

Interpretation: The initial impulse of decreasing the Element "Payments for loans" slightly increases the Element "Asset price".

Paths from Element 18 (Payments for loans) to Element 19 (Liquidity of banks)

Relevance: Action 3-4 "Debt moratoria for financed investors"

Results: The initial impulse of a decrease of the Element "Payments for loans" leads to a decrease of the Element "Liquidity of banks" in 65 cases. In 65 cases the initial impulse of an increase of the Element "Payments for loans" leads to an increase of the Element "Liquidity of banks". For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.7 for positive paths and 14.9 for negative paths. The median is 16.0 for positive paths and 15.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-74 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

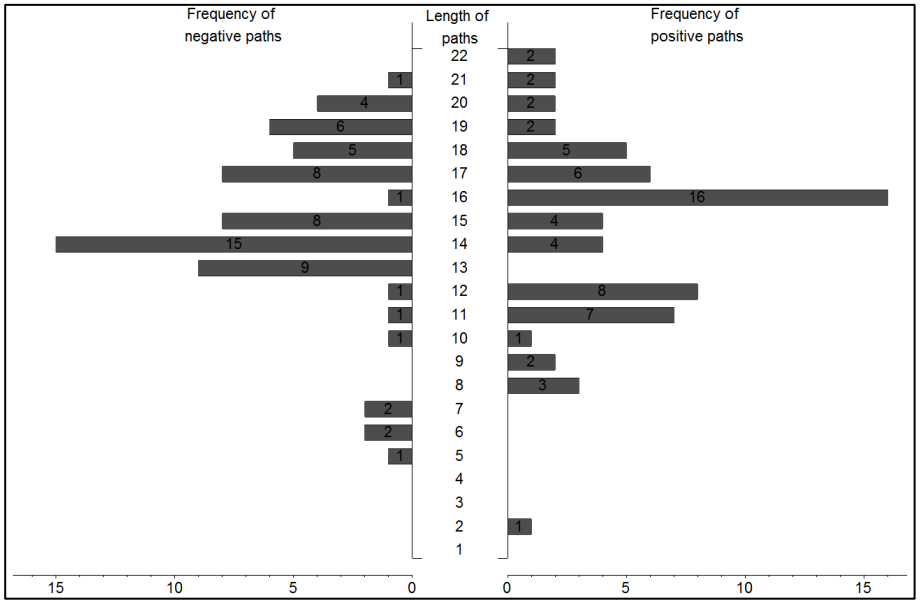


Figure 5-74: Length of paths from Element 18 to Element 19 (from Element "Payments for loans" to Element "Liquidity of banks")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 18 to Element 19. Indirectly, the Elements "Asset price", "Attractiveness of financed investments", "New loans for investments" and "Risk of debt default" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-75 shows the respective distribution. For a

detailed list of numbers please refer to Appendix 6.

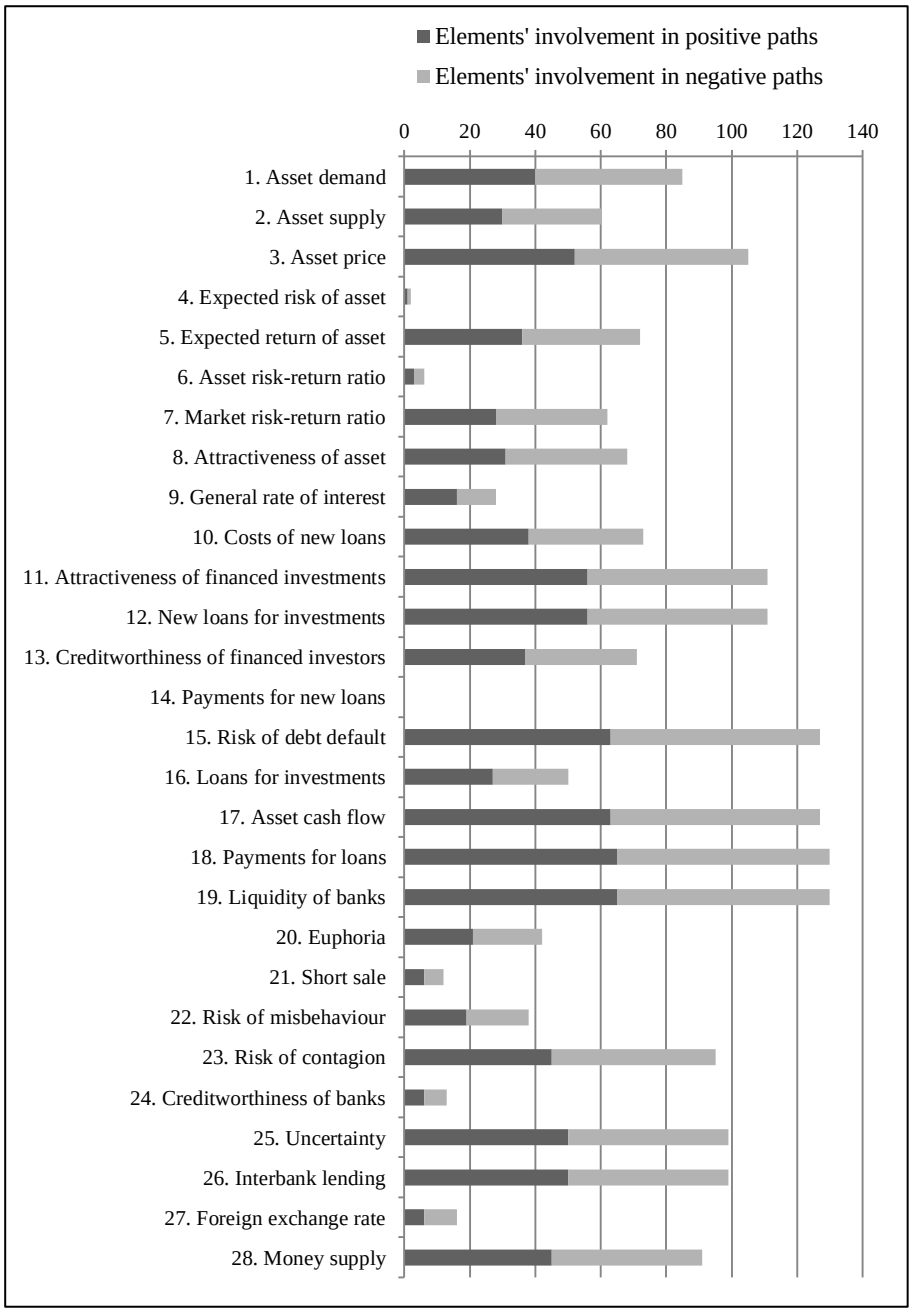


Figure 5-75: Involvement of elements in paths from Element 18 to Element 19 (from Element "Payments for loans" to Element "Liquidity of banks")

Interpretation: The initial impulse of decreasing the Element "Payments for loans" neither increases nor decreases the Element "Liquidity of banks".

Paths from Element 18 (Payments for loans) to Element 27 (Foreign exchange rate)

Relevance: Action 3-4 "Debt moratoria for financed investors"

Results: The initial impulse of a decrease of the Element "Payments for loans" leads to a decrease of the Element "Foreign exchange rate" in 34 cases. In 38 cases the initial impulse of a decrease of the Element "Payments for loans" leads to an increase of the Element "Foreign exchange rate" 5.6% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter positive paths are equalised by longer positive paths. The mean is 17.6 for positive paths and 16.6 for negative paths. The median is 18.0 for positive paths and 16.0 for negative paths. The spreads of the lengths are almost identical for positive and negative paths. Figure 5-76 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

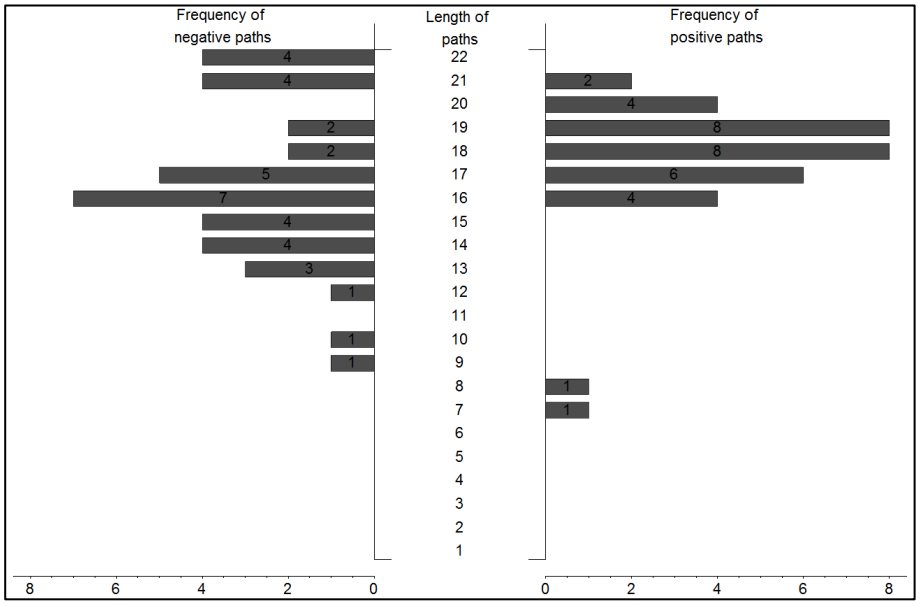


Figure 5-76: Length of paths from Element 18 to Element 27 (from Element "Payments for loans" to Element "Foreign exchange rate")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 18 to Element 27. Indirectly, the Elements "Asset price", "Expected return of asset",

"Risk of debt default", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Market risk-return ratio", "Attractiveness of asset", "Risk of contagion" and "Creditworthiness of banks" are more often involved in positive paths. The Elements "Costs of new loans", "New loans for investments" and "Creditworthiness of financed investors" are more often involved in negative paths. Figure 5-77 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

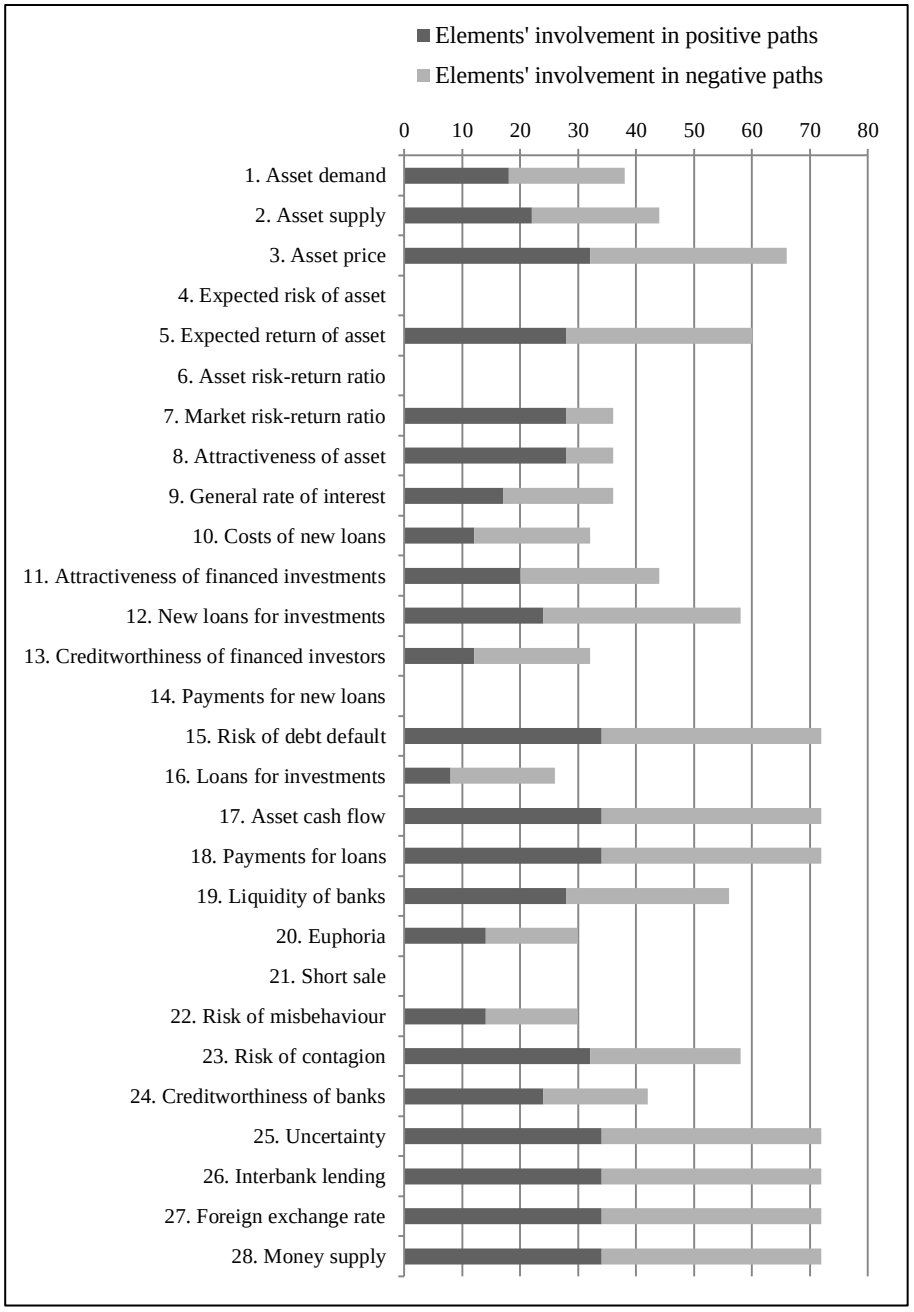


Figure 5-77: Involvement of elements in paths from Element 18 to Element 27 (from Element "Payments for loans" to Element "Foreign exchange rate")

Interpretation: The initial impulse of decreasing the Element "Payments for loans" increases the Element "Foreign exchange rate".

Paths from Element 19 (Liquidity of banks) to Element 3 (Asset price)

Relevance: Action 1-7 "Asset purchases from banks"
Action 2-1 "Provision of liquidity to banks"
Action 2-3 "Provision of foreign liquidity"
Action 3-2 "Asset purchase programme"
Action 3-6 "Deposit freezing or bank holidays"

Results: The initial impulse of an increase of the Element "Liquidity of banks" leads to an increase of the Element "Asset price" in 27 cases. In 27 cases the initial impulse of an increase of the Element "Liquidity of banks" leads to a decrease of the Element "Asset price". For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 11.9 for positive paths and 12.3 for negative paths. The median is 12.0 for both. The spread of the lengths of positive paths is greater. Figure 5-78 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

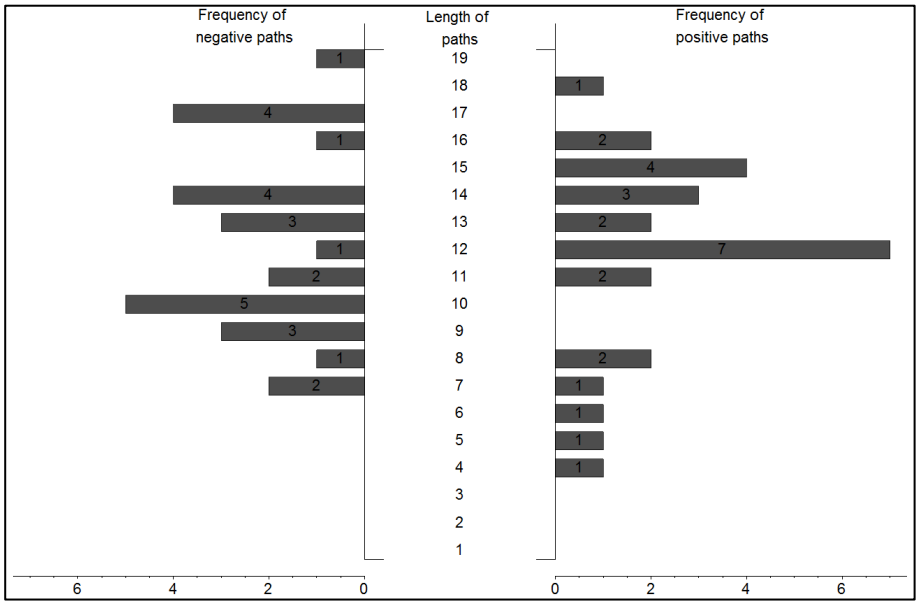


Figure 5-78: Length of paths from Element 19 to Element 3 (from Element "Liquidity of banks" to Element "Asset price")

Next to other elements, the Element "New loans for investments" is directly related and, therefore, more often involved in paths from

Element 19 to Element 3. Indirectly, the Elements "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-79 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

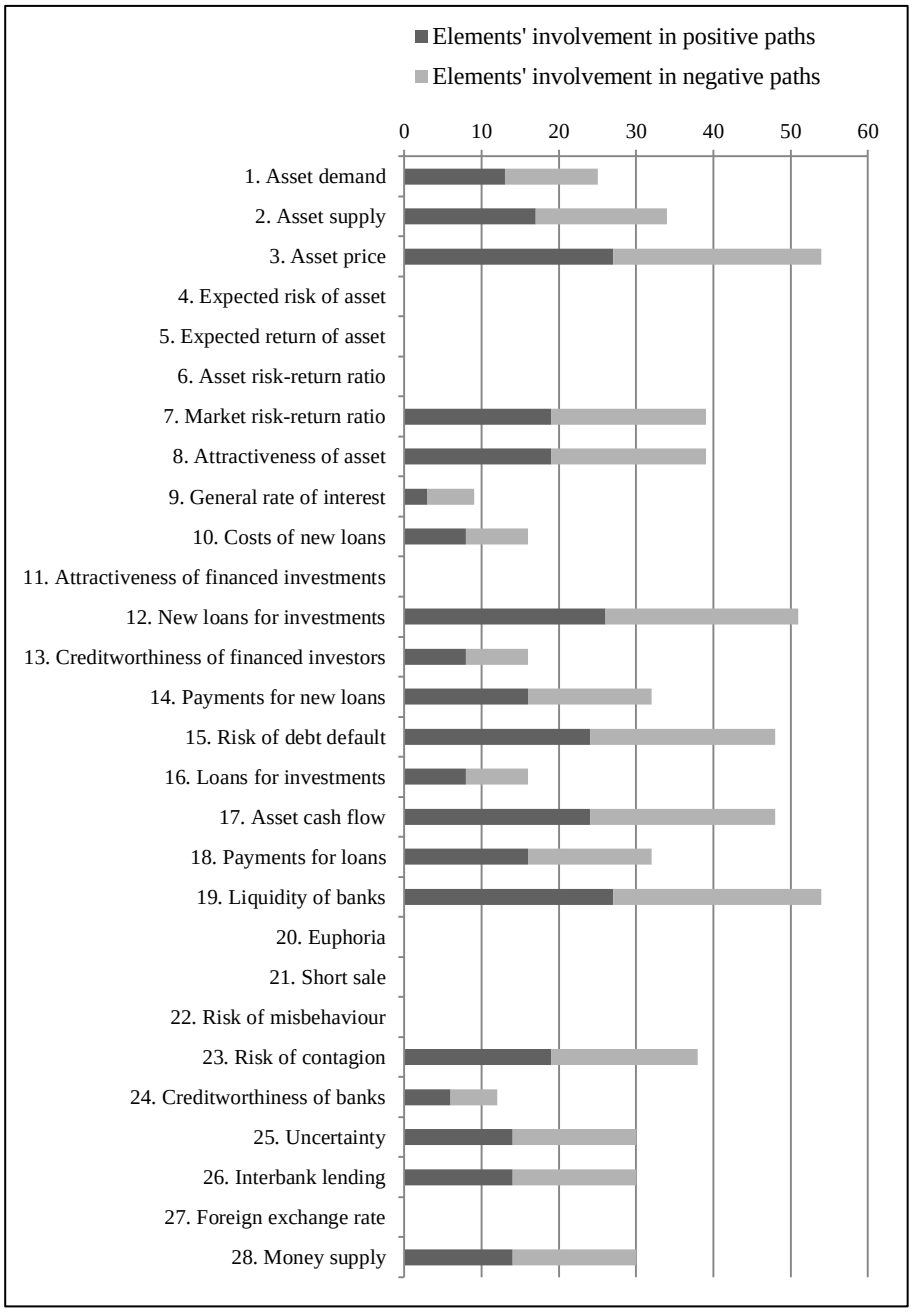


Figure 5-79: Involvement of elements in paths from Element 19 to Element 3 (from Element "Liquidity of banks" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Liquidity of banks" neither increases nor decreases the Element "Asset price".

Paths from Element 19 (Liquidity of banks) to Element 27 (Foreign exchange rate)

Relevance: Action 1-7 "Asset purchases from banks"
Action 2-1 "Provision of liquidity to banks"
Action 2-3 "Provision of foreign liquidity"
Action 3-2 "Asset purchase programme"
Action 3-6 "Deposit freezing or bank holidays"

Results: The initial impulse of an increase of the Element "Liquidity of banks" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 46 cases the initial impulse of an increase of the Element "Liquidity of banks" leads to a decrease of the Element "Foreign exchange rate" 2.2% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 16.9 for positive paths and negative paths. The median is 17.0 for positive paths and 16.0 for negative paths. The spread of the lengths is higher for negative paths. Figure 5-80 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

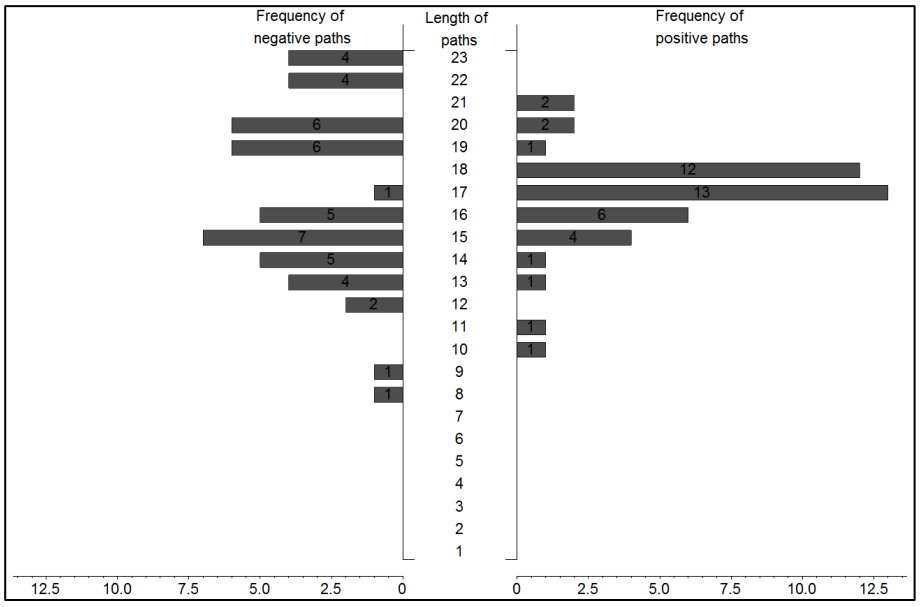


Figure 5-80: Length of paths from Element 19 to Element 27 (from Element "Liquidity of banks" to Element "Foreign exchange rate")

Next to other elements, the Element “New loans for investments” is directly related and, therefore, more often involved in paths from Element 19 to Element 27. Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Risk of contagion”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Market risk-return ratio“ and “Attractiveness of asset” are more often involved in positive paths. The Elements “New loans for investments“, “Payments for new loans” and “Payments for loans” are more often involved in negative paths. Figure 5-81 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

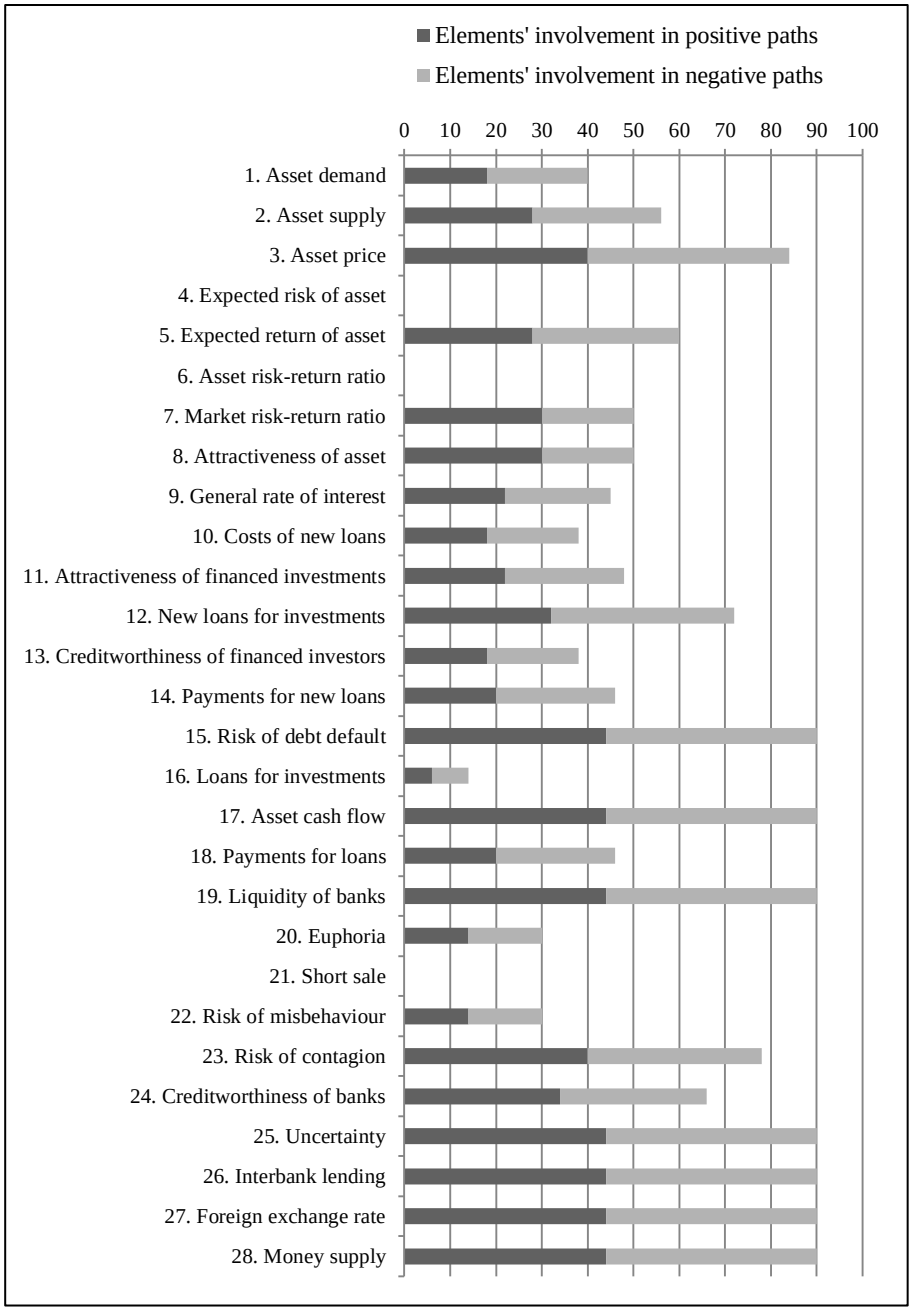


Figure 5-81: Involvement of elements in paths from Element 19 to Element 27 (from Element "Liquidity of banks" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Liquidity of banks" slightly reduces the Element "Foreign exchange rate".

Paths from Element 21 (Short sales) to Element 3 (Asset price)

Relevance: Action 3-9 "Prohibition of short sales"

Results: The initial impulse of a decrease of the Element "Short sales" leads to a decrease of the Element "Asset price" in 6 cases. In 7 cases the initial impulse of a decrease of the Element "Short sales" leads to an increase of the Element "Asset price" 7.7% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 11.5 for positive paths and 12.9 for negative paths. The median is 13.0 for positive paths and 14.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. For a detailed list of numbers please refer to Appendix 5.

The Elements "Asset supply" and "Asset demand" are directly related and, therefore, more often involved in paths from Element 21 to Element 3. Indirectly, the Element "Risk of contagion" plays a significant role. Elements are equally involved in positive and negative paths. Figure 5-82 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

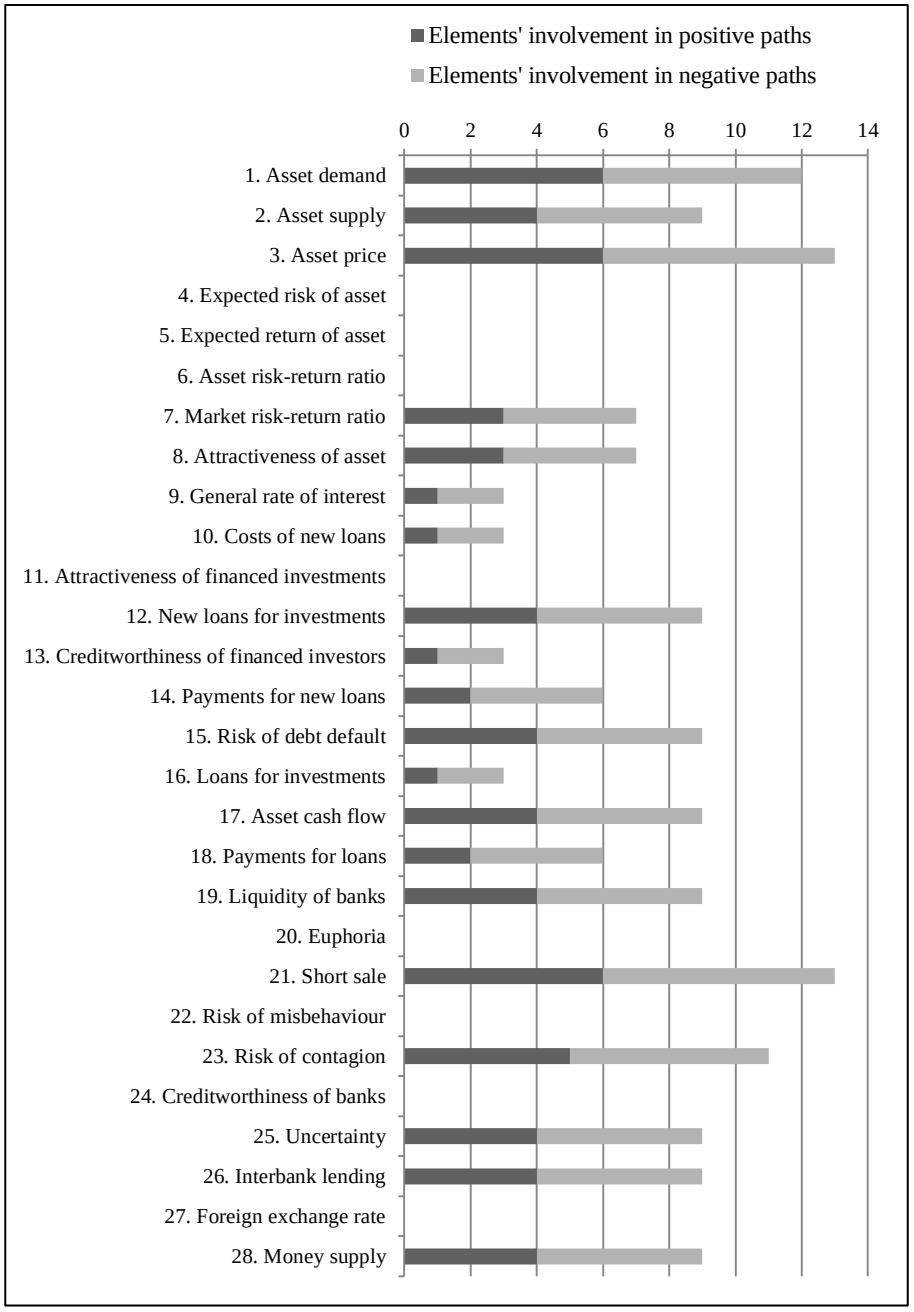


Figure 5-82: Involvement of elements in paths from Element 21 to Element 3 (from Element "Short sales" to Element "Asset price")

Interpretation: The initial impulse of decreasing the Element "Short sales" increases the Element "Asset price" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Short sales" slightly increases the Element "Asset price".

Paths from Element 21 (Short sales) to Element 19 (Liquidity of banks)

Relevance: Action 3-9 "Prohibition of short sales"

Results: The initial impulse of a decrease of the Element "Short sales" leads to a decrease of the Element "Liquidity of banks" in 184 cases. In 191 cases the initial impulse of a decrease of the Element "Short sales" leads to an increase of the Element "Liquidity of banks". 1.9% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.2 for positive paths and 15.1 for negative paths. The median is 15.0 for both. The spread of the lengths is higher for positive paths. Figure 5-83 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

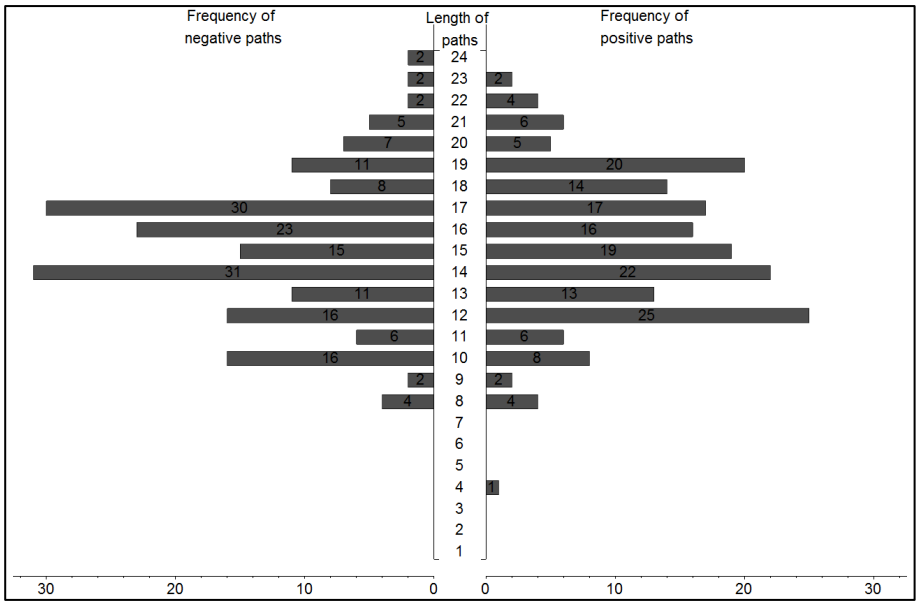


Figure 5-83: Length of paths from Element 21 to Element 19 (from Element "Short sales" to Element "Liquidity of banks")

Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles in paths from Element 21 to Element 19. Elements are equally involved in positive and negative paths. Figure 5-84 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

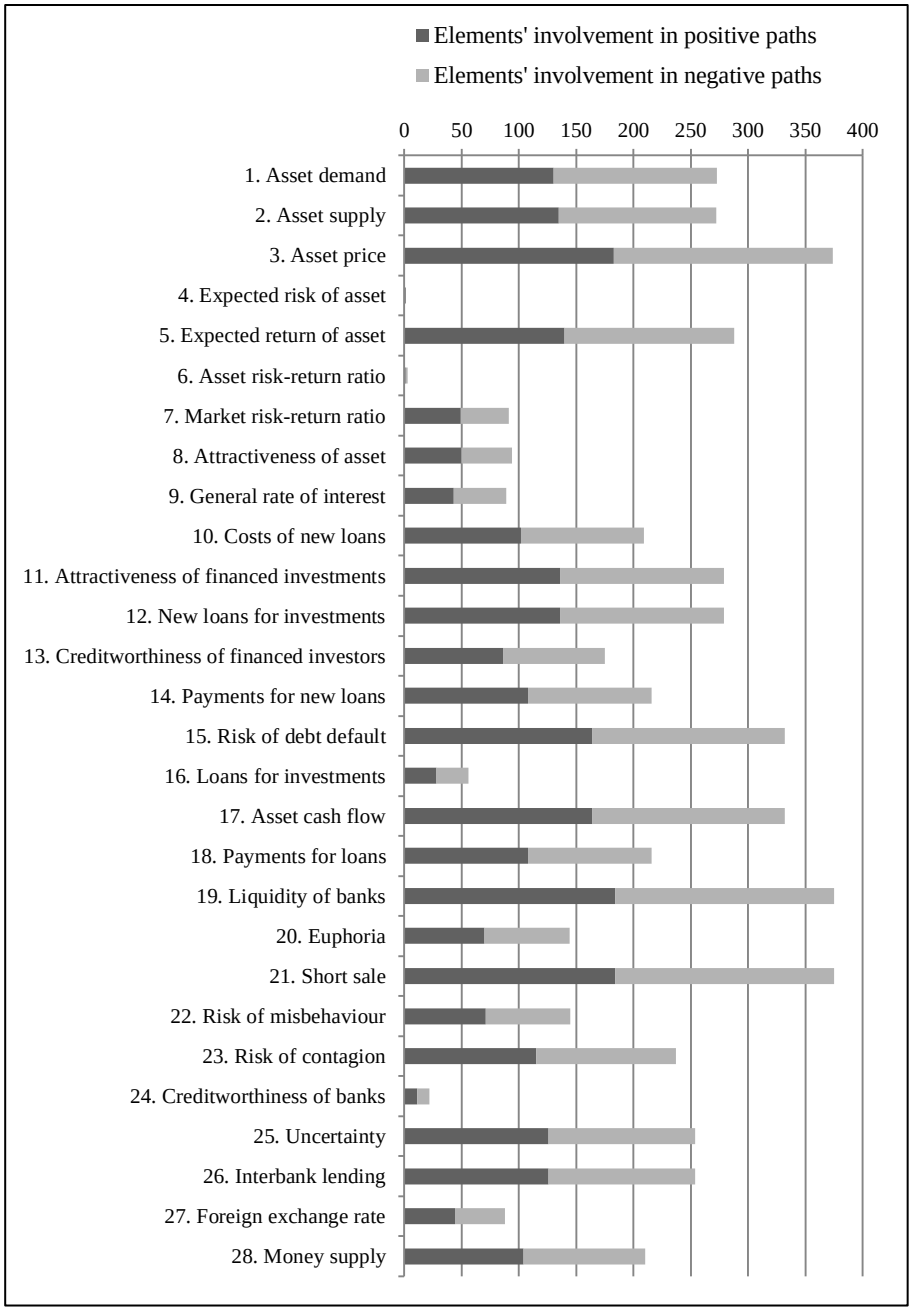


Figure 5-84: Involvement of elements in paths from Element 21 to Element 19 (from Element "Short sales" to Element "Liquidity of banks")

Interpretation: The initial impulse of decreasing the Element "Short sales" slightly increases the Element "Liquidity of banks".

Paths from Element 21 (Short sales) to Element 27 (Foreign exchange rate)

Relevance: Action 3-9 "Prohibition of short sales"

Results: The initial impulse of a decrease of the Element "Short sales" leads to a decrease of the Element "Foreign exchange rate" in 60 cases. In 60 cases the initial impulse of a decrease of the Element "Short sales" leads to an increase of the Element "Foreign exchange rate". For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 16.5 for positive paths and 16.7 for negative paths. The median is 17.0 for positive paths and 16.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. Figure 5-85 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

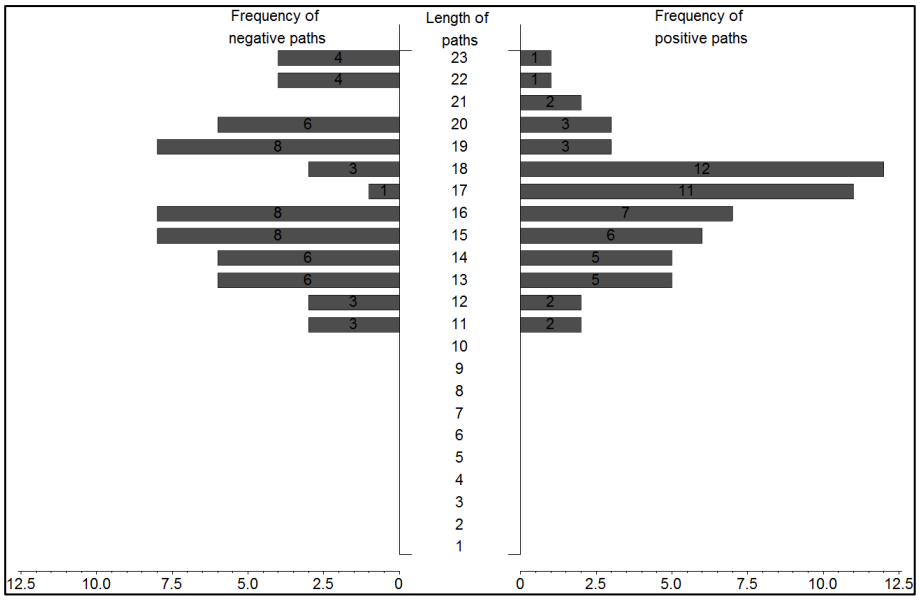


Figure 5-85: Length of paths from Element 21 to Element 27 (from Element "Short sales" to Element "Foreign exchange rate")

Indirectly, the Elements "Asset price", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles in paths from Element 21 to Element 27. Elements are equally involved in positive and negative paths. Figure 5-86 shows the respective distribution. For a detailed list of numbers please refer to

Appendix 6.

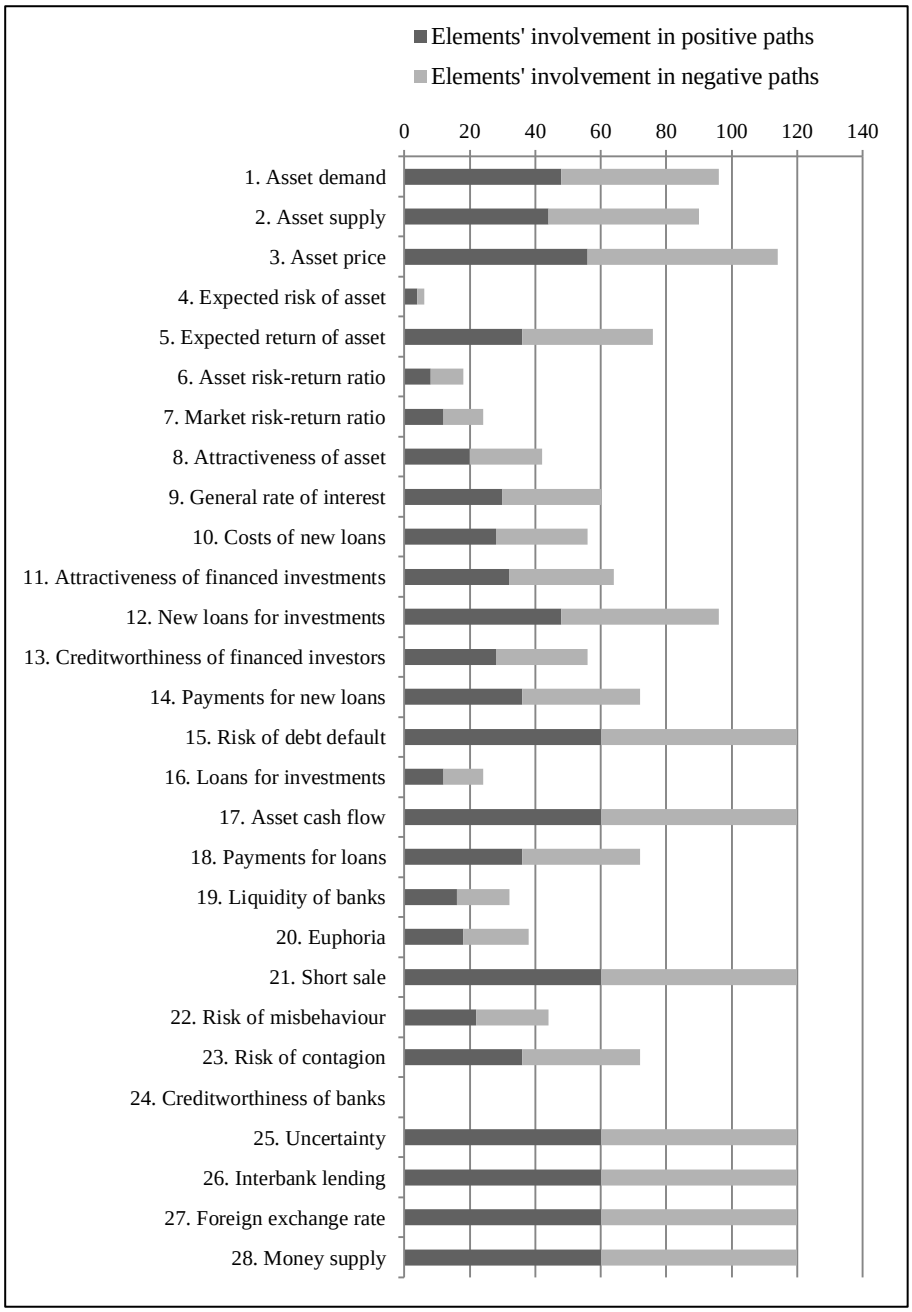


Figure 5-86: Involvement of elements in paths from Element 21 to Element 27 (from Element "Short sales" to Element "Foreign exchange rate")

Interpretation: The initial impulse of decreasing the Element "Short sales" neither increases nor decreases the Element "Foreign exchange rate".

Paths from Element 24 (Creditworthiness of banks) to Element 3 (Asset price)

Relevance: Action 1-8 "Lightening of collateral requirements"
Action 3-1 "Deposit insurance, guarantees and nationalisation"
Action 3-3 "Asset transfer programme"
Action 3-5 "Accounting discretion"

Results: The initial impulse of an increase of the Element "Creditworthiness of banks" leads to an increase of the Element "Asset price" in 9 cases. In 10 cases the initial impulse of an increase of the Element "Creditworthiness of banks" leads to a decrease of the Element "Asset price" 5.3% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 12.7 for positive paths and 13.5 for negative paths. The median is 14.0 for both. The spreads of the lengths are almost identical for positive and negative paths. For a detailed list of numbers please refer to Appendix 5.

The Element "Risk of contagion" is directly related and, therefore, more often involved in paths from Element 24 to Element 3. Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-87 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

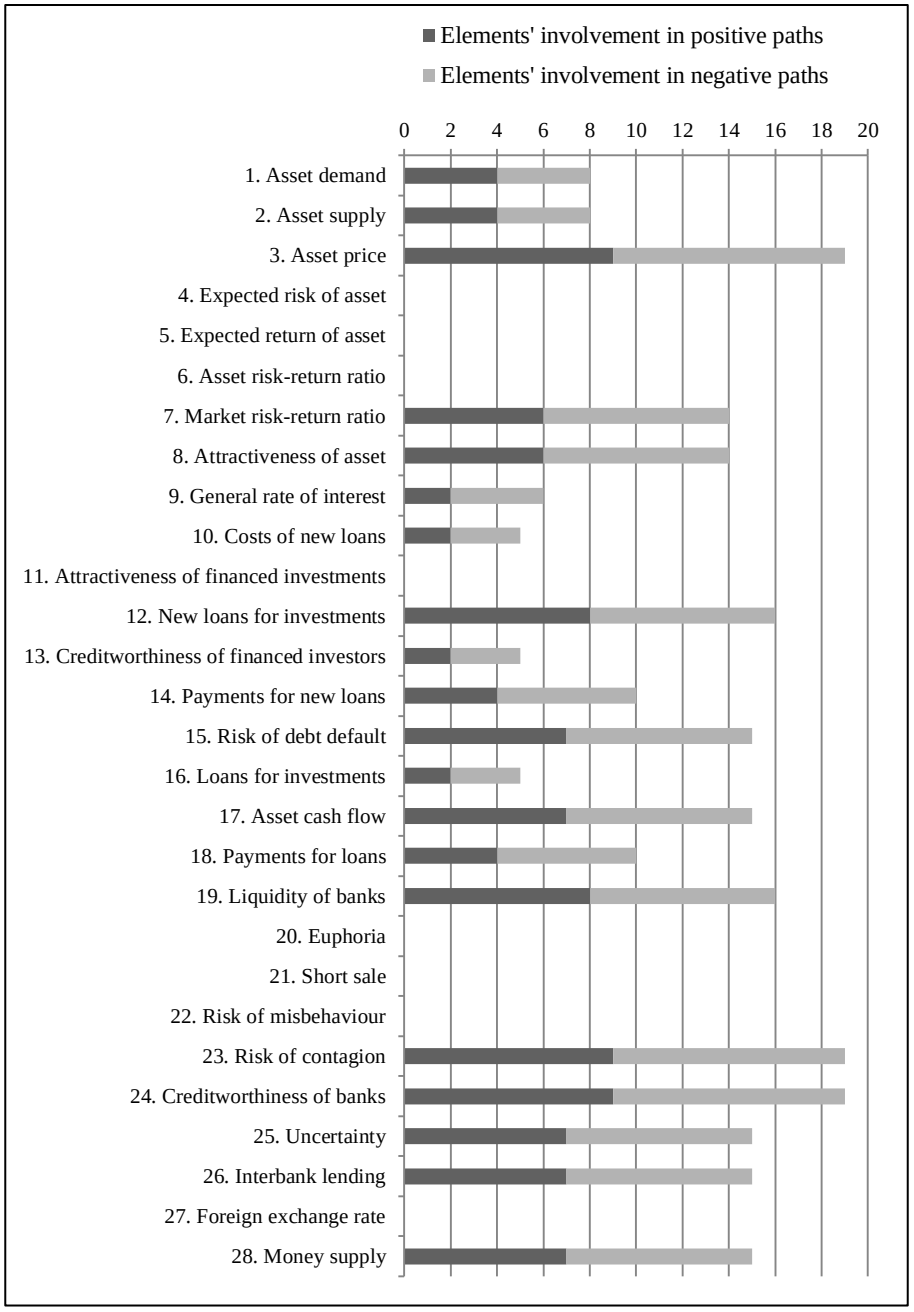


Figure 5-87: Involvement of elements in paths from Element 24 to Element 3 (from Element "Creditworthiness of banks" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of banks" decreases the Element "Asset price".

Paths from Element 24 (Creditworthiness of banks) to Element 19 (Liquidity of banks)

Relevance: Action 1-8 "Lightening of collateral requirements"
Action 3-1 "Deposit insurance, guarantees and nationalisation"
Action 3-3 "Asset transfer programme"
Action 3-5 "Accounting discretion"

Results: The initial impulse of an increase of the Element "Creditworthiness of banks" leads to an increase of the Element "Liquidity of banks" in 108 cases. In 100 cases the initial impulse of an increase of the Element "Creditworthiness of banks" leads to a decrease of the Element "Liquidity of banks" 3.8% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 16.2 for both. The median is 17.0 for positive paths and 16.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-88 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

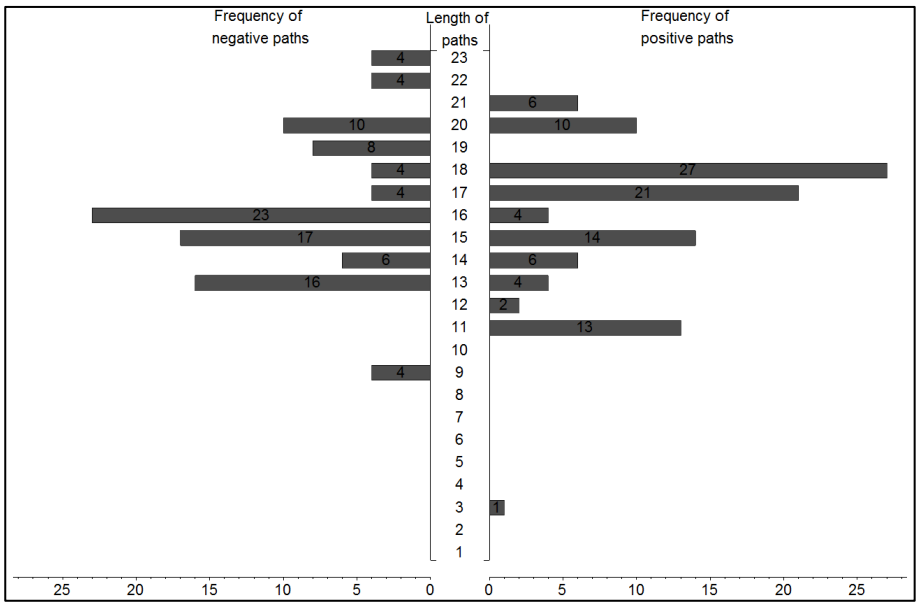


Figure 5-88: Length of paths from Element 24 to Element 19 (from Element "Creditworthiness of banks" to Element "Liquidity of banks")

The Element "Risk of contagion" is directly related and, therefore, more

often involved in paths from Element 24 to Element 19. Indirectly, the Elements “Asset price”, “Risk of debt default” and “Asset cash flow” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Asset demand“, “Market risk-return ratio” and “Attractiveness of asset” are more often involved in positive paths. Figure 5-89 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

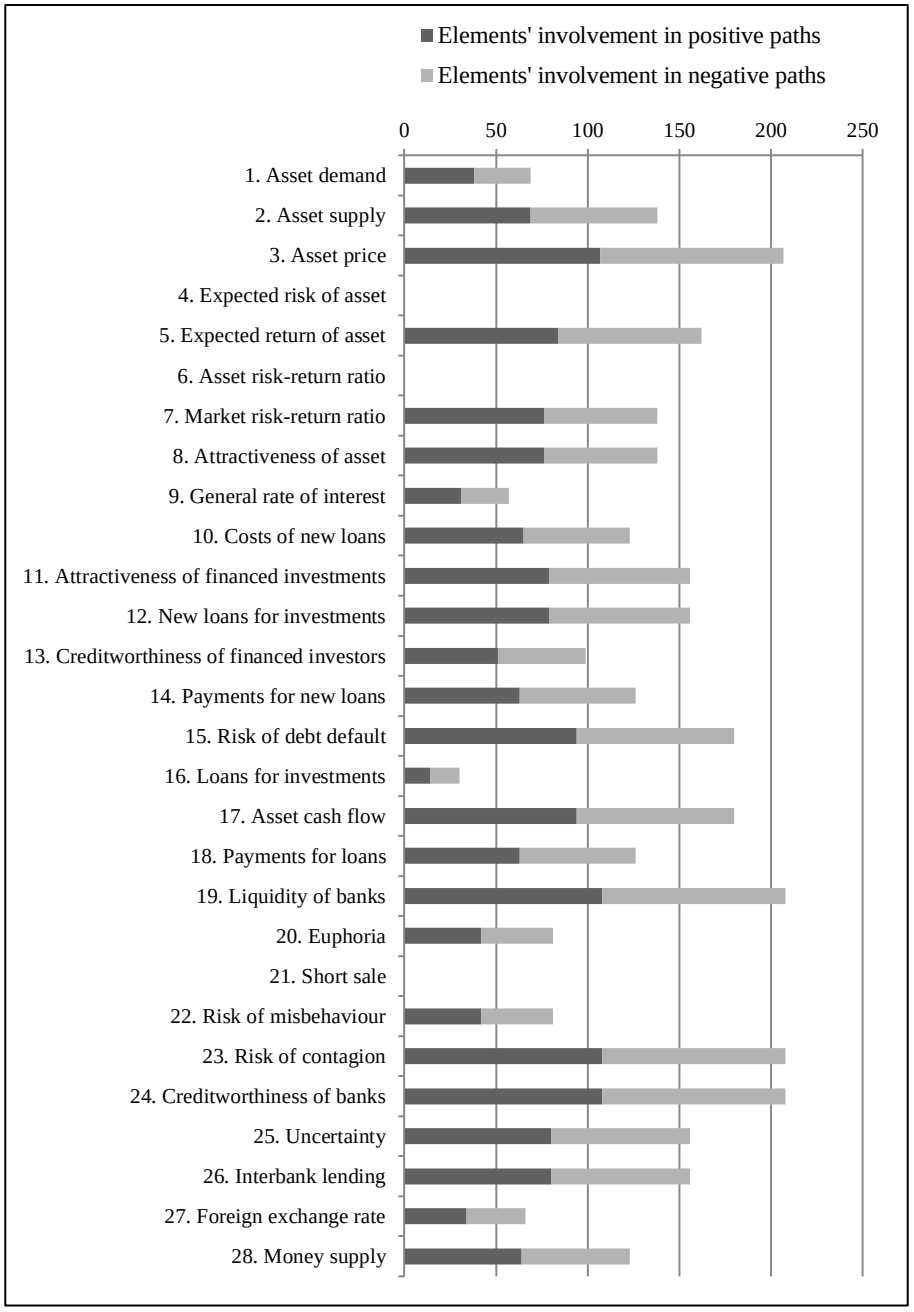


Figure 5-89: Involvement of elements in paths from Element 24 to Element 19 (from Element "Creditworthiness of banks" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of banks" slightly increases the Element "Liquidity of banks".

Paths from Element 24 (Creditworthiness of banks) to Element 27 (Foreign exchange rate)

Relevance: Action 1-8 "Lightening of collateral requirements"
Action 3-1 "Deposit insurance, guarantees and nationalisation"
Action 3-3 "Asset transfer programme"
Action 3-5 "Accounting discretion"

Results: The initial impulse of an increase of the Element "Creditworthiness of banks" leads to an increase of the Element "Foreign exchange rate" in 40 cases. In 44 cases the initial impulse of an increase of the Element "Creditworthiness of banks" leads to a decrease of the Element "Foreign exchange rate" 4.8% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 16.2 for positive paths and 17.0 for negative paths. The median is 16.0 for positive paths and 18.0 for negative paths. The spread of the lengths is higher for negative paths. Figure 5-90 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

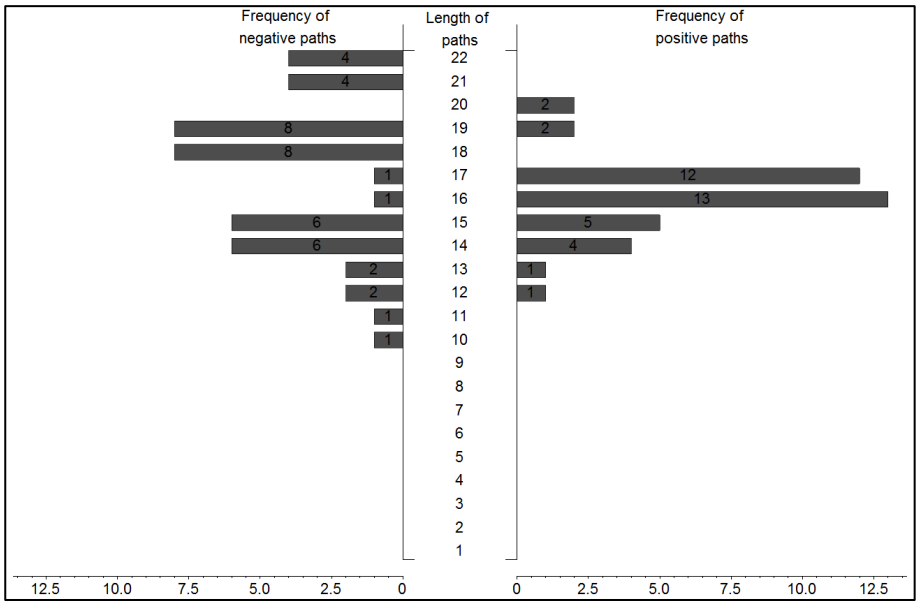


Figure 5-90: Length of paths from Element 24 to Element 27 (from Element "Creditworthiness of banks" to Element "Foreign exchange rate")

The Element “Risk of contagion” is directly related and, therefore, more often involved in paths from Element 24 to Element 27. Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Payments for new loans “ and “Payments for loans” are more often involved in negative paths. Figure 5-91 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

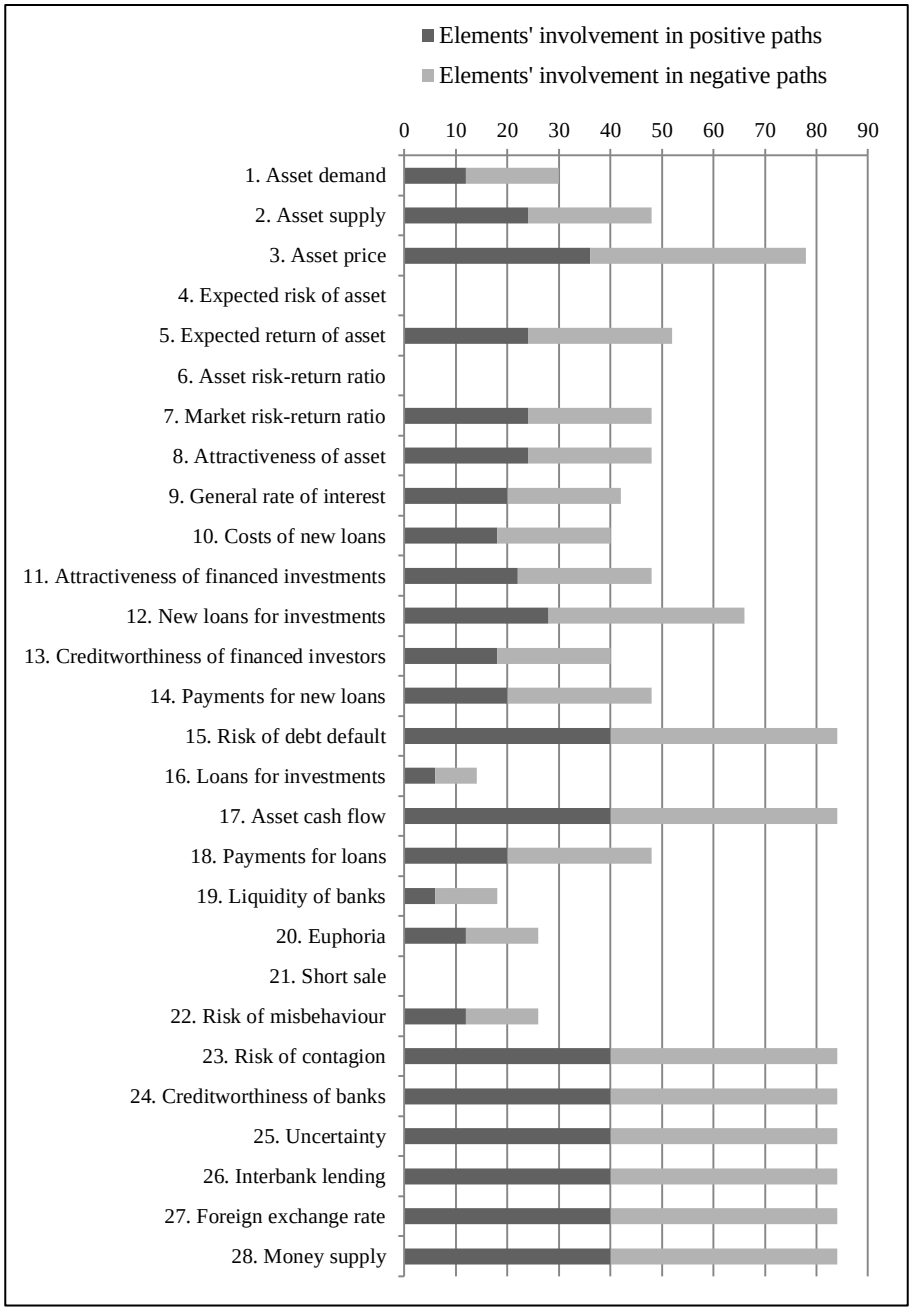


Figure 5-91: Involvement of elements in paths from Element 24 to Element 27 (from Element "Creditworthiness of banks" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of banks" slightly reduces the Element "Foreign exchange rate".

Paths from Element 25 (Uncertainty) to Element 3 (Asset price)

Relevance: Action 3-8 "Stress tests"

Results: The initial impulse of a decrease of the Element "Uncertainty" leads to a decrease of the Element "Asset price" in 72 cases. In 76 cases the initial impulse of a decrease of the Element "Uncertainty" leads to an increase of the Element "Asset price" 2.7% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 13.2 for both. The median is 13.0 for positive paths and 14.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. Figure 5-92 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

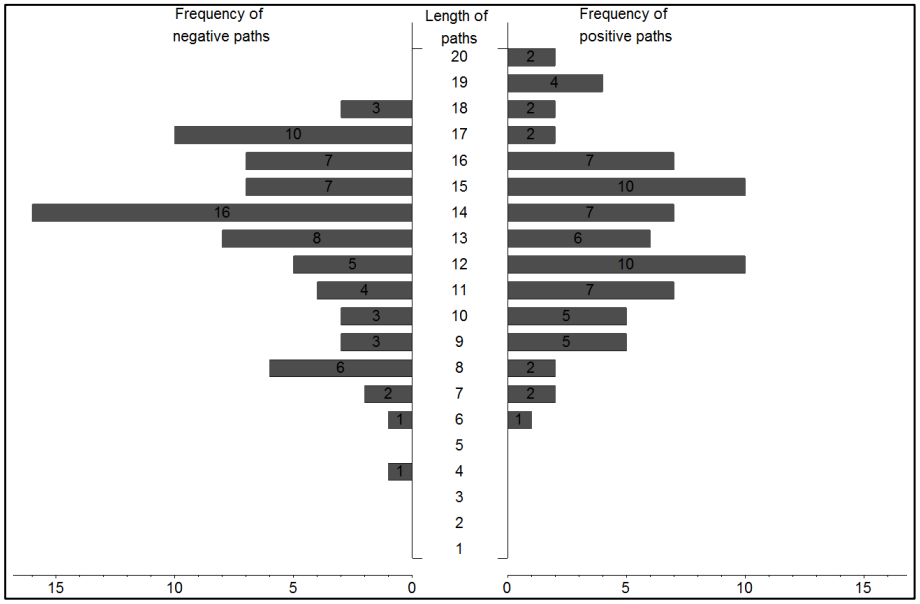


Figure 5-92: Length of paths from Element 25 to Element 3 (from Element "Uncertainty" to Element "Asset price")

The Element "Interbank lending" is directly related and, therefore, more often involved in paths from Element 25 to Element 3. Indirectly, the Elements "Risk of contagion" and "Money supply" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-93 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

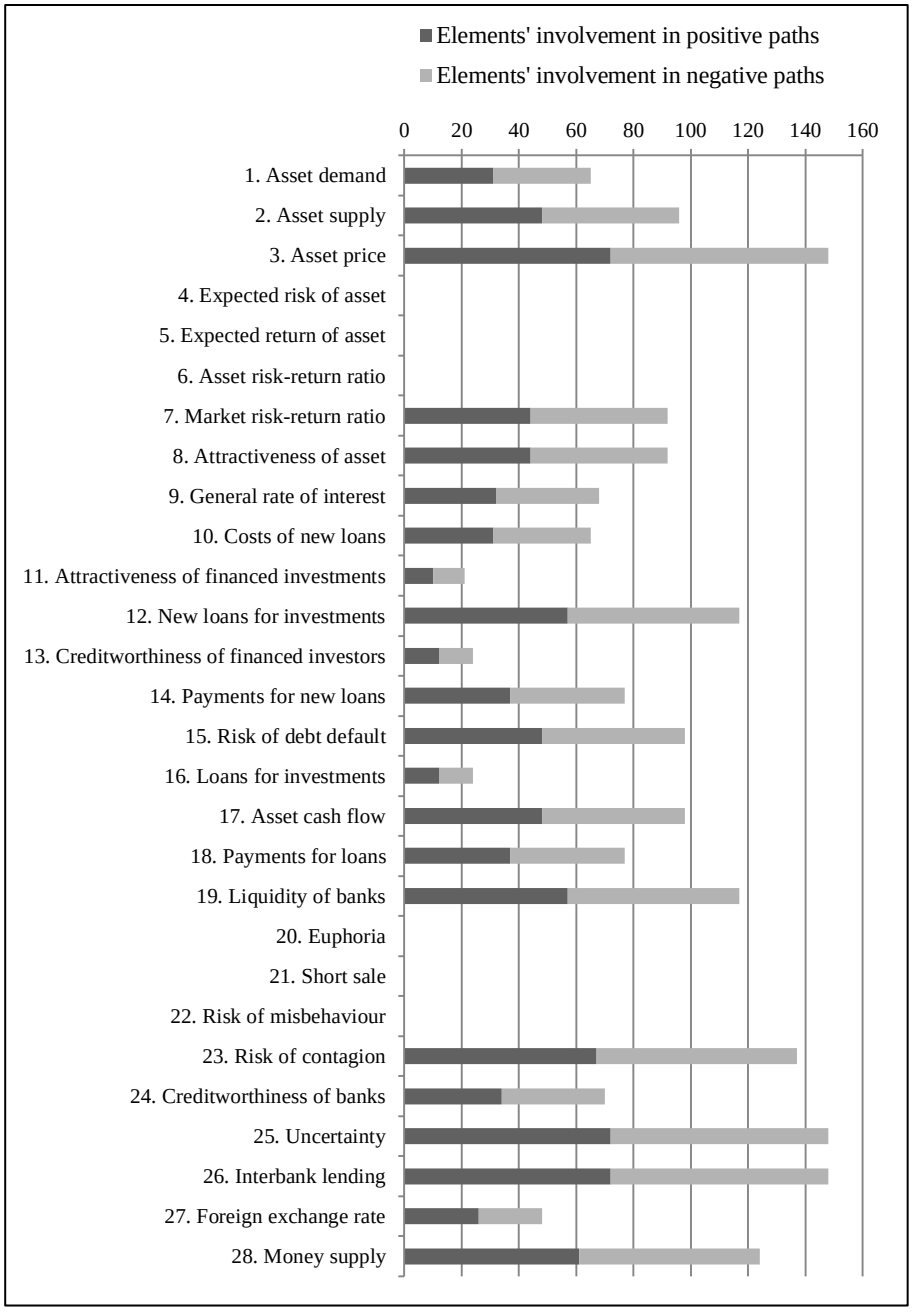


Figure 5-93: Involvement of elements in paths from Element 25 to Element 3 (from Element "Uncertainty" to Element "Asset price")

Interpretation: The initial impulse of decreasing the Element "Uncertainty" slightly increases the Element "Asset price".

Paths from Element 25 (Uncertainty) to Element 19 (Liquidity of banks)

Relevance: Action 3-8 "Stress tests"

Results: The initial impulse of a decrease of the Element "Uncertainty" leads to an decrease of the Element "Liquidity of banks" in 163 cases. In 174 cases the initial impulse of a decrease of the Element "Uncertainty" leads to an increase of the Element "Liquidity of banks". 3.3% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.6 for positive paths and 15.5 for negative paths. The median is 16.0 for both. The spreads of the lengths are almost identical for positive and negative paths. Figure 5-94 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

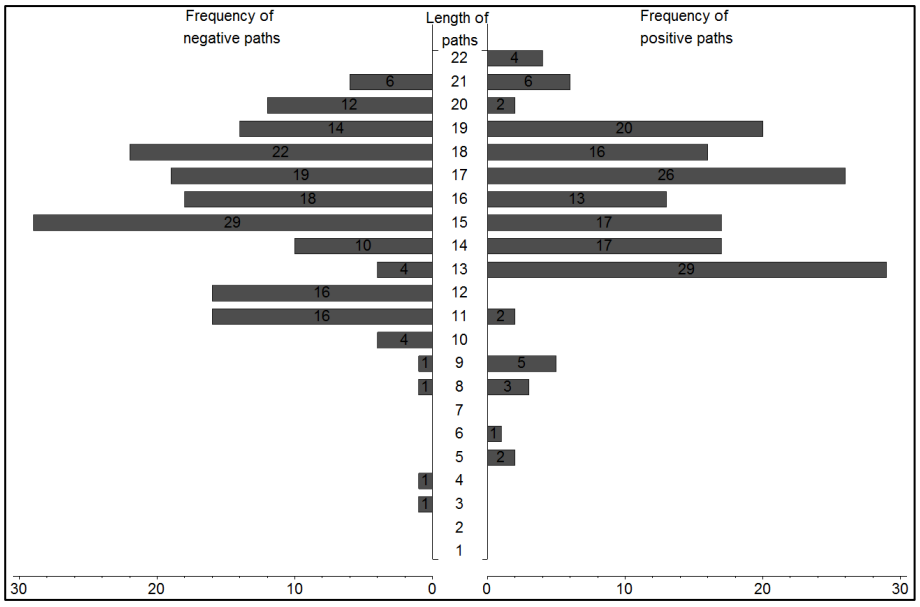


Figure 5-94: Length of paths from Element 25 to Element 19 (from Element "Uncertainty" to Element "Liquidity of banks")

The Element "Interbank lending" is directly related and, therefore, more often involved in paths from Element 25 to Element 19. Indirectly, the Elements "Asset price" and "Money supply" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-95 shows the respective distribution. For a detailed list of numbers please

refer to Appendix 6.

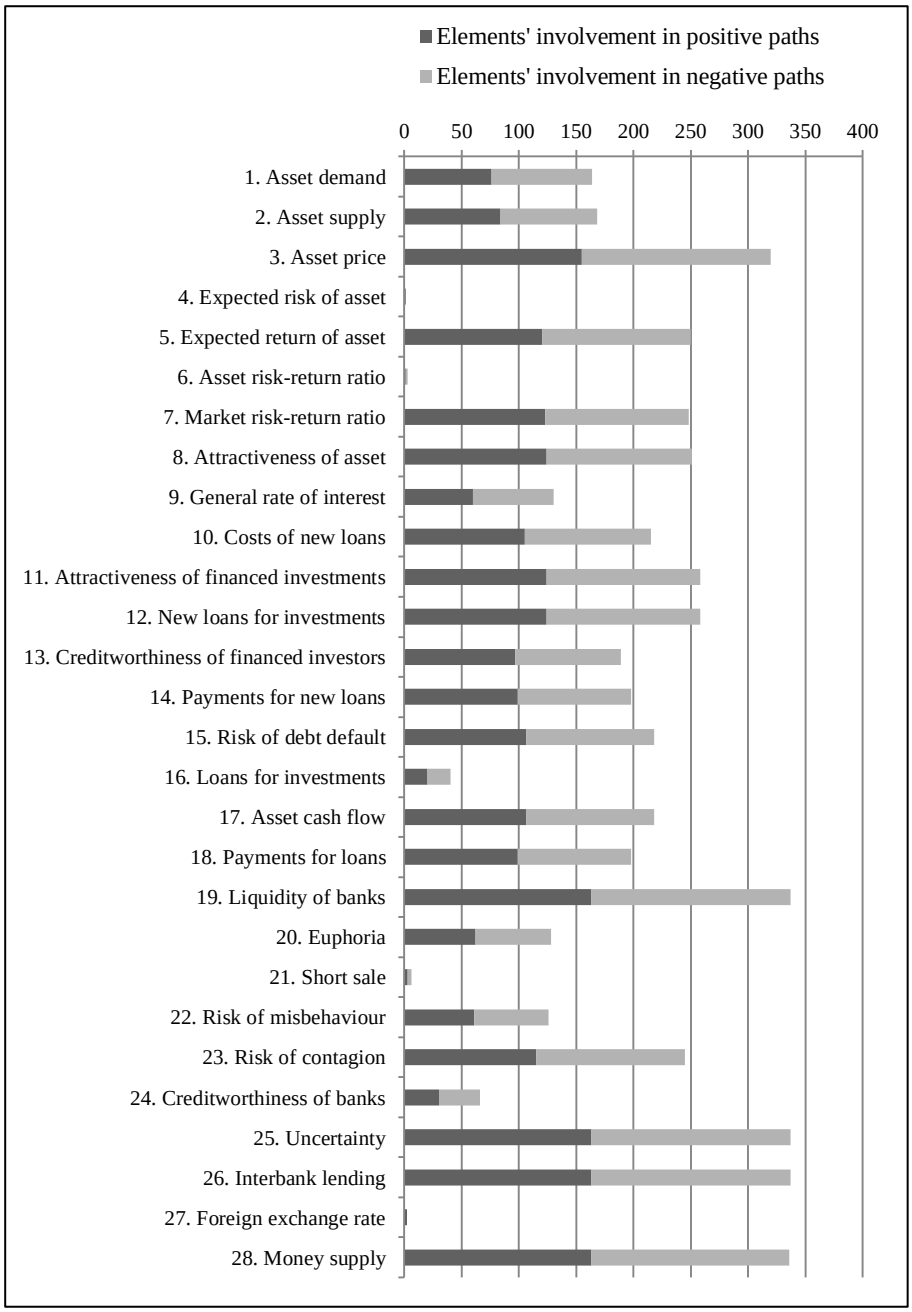


Figure 5-95: Involvement of elements in paths from Element 25 to Element 19 (from Element "Uncertainty" to Element "Liquidity of banks")

Interpretation: The initial impulse of decreasing the Element "Uncertainty" slightly increases the Element "Liquidity of banks".

Paths from Element 25 (Uncertainty) to Element 27 (Foreign exchange rate)

Relevance: Action 3-8 "Stress tests"

Results: The initial impulse of a decrease of the Element "Uncertainty" leads to a decrease of the Element "Foreign exchange rate" in 2 cases. In 0 cases the initial impulse of a decrease of the Element "Uncertainty" leads to an increase of the Element "Foreign exchange rate". For a detailed list of paths please refer to Appendix 4.

Affected elements are exclusively involved either in positive or negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of decreasing the Element "Uncertainty" reduces the Element "Foreign exchange rate".

Paths from Element 27 (Foreign exchange rate) to Element 3 (Asset price)

Relevance: Action 1-4 "Appreciation of domestic currency"
Action 1-5 "Depreciation of domestic currency"

Results: The initial impulse of an increase of the Element "Foreign exchange rate" leads to an increase of the Element "Asset price" in 27 cases. In 27 cases the initial impulse of an increase of the Element "Foreign exchange rate" leads to a decrease of the Element "Asset price". For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 12.9 for positive paths and 13.3 for negative paths. The median is 13.0 for both. The spread of the lengths of positive paths is greater. Figure 5-96 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

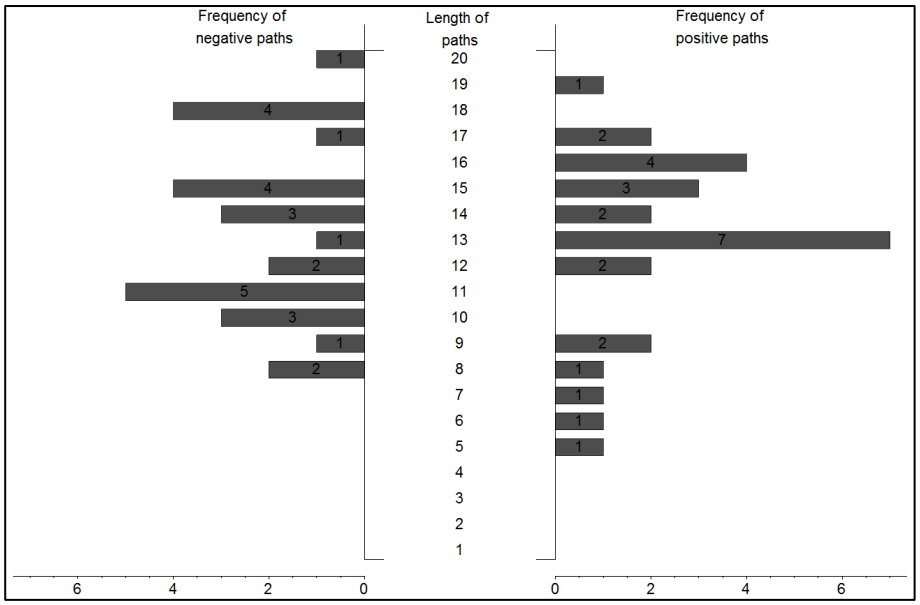


Figure 5-96: Length of paths from Element 27 to Element 3 (from Element "Foreign exchange rate" to Element "Asset price")

The Element "Liquidity of banks" is directly related and, therefore, more often involved in paths from Element 27 to Element 3. Indirectly, the Elements "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-97 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

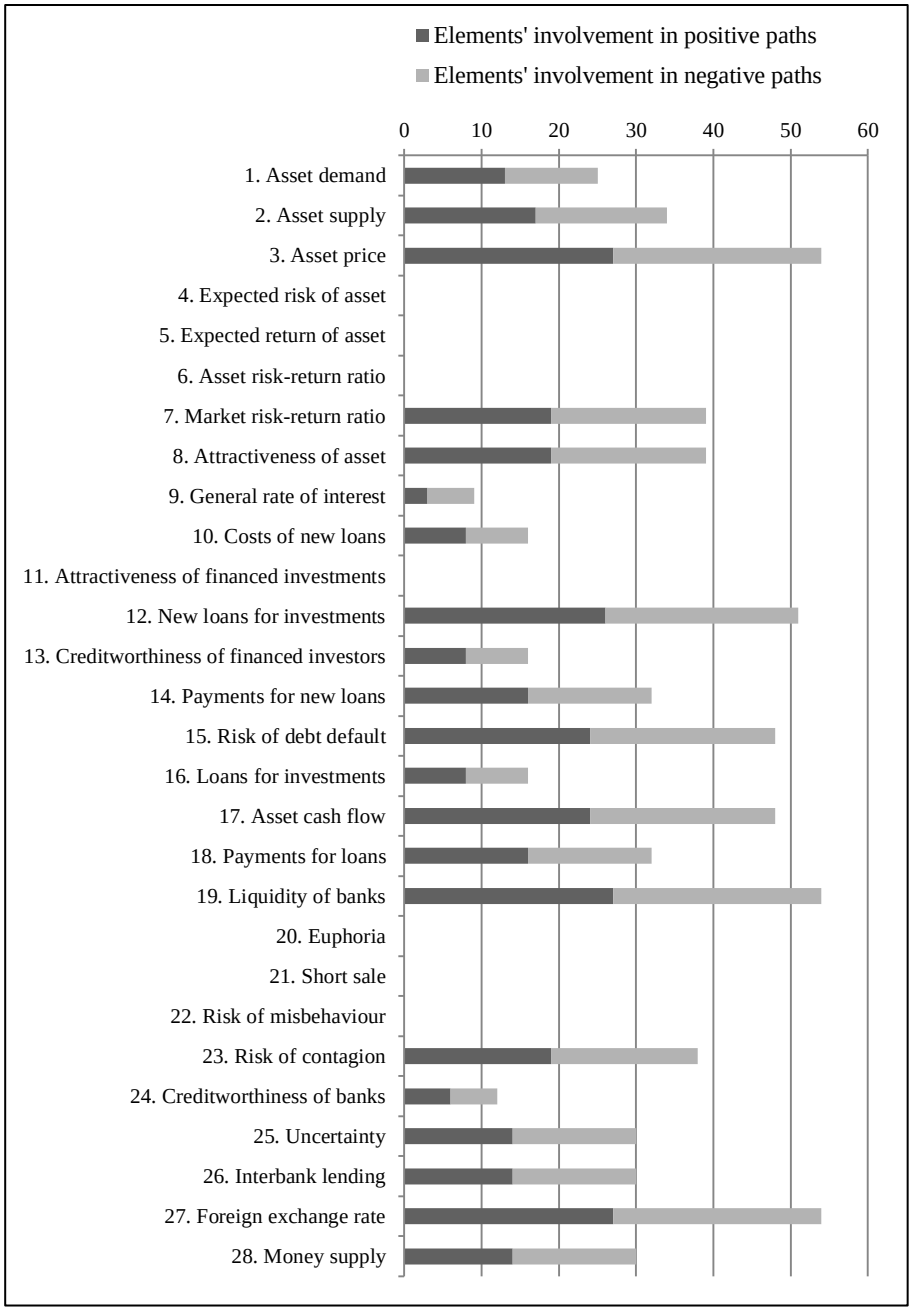


Figure 5-97: Involvement of elements in paths from Element 27 to Element 3 (from Element "Foreign exchange rate" to Element "Asset price")

Interpretation: The initial impulses of increasing or decreasing the Element "Foreign exchange rate" neither increase nor decrease the Element "Asset price".

Paths from Element 27 (Foreign exchange rate) to Element 19 (Liquidity of banks)

Relevance: Action 1-4 "Appreciation of domestic currency"
Action 1-5 "Depreciation of domestic currency"

Results: The initial impulse of an increase of the Element "Foreign exchange rate" leads to an increase of the Element "Liquidity of banks" in 1 case. In 0 cases the initial impulse of an increase of the Element "Foreign exchange rate" leads to a decrease of the Element "Liquidity of banks". The initial impulse of an decrease of the Element "Foreign exchange rate" leads to an decrease of the Element "Liquidity of banks" in 1 case. In 0 cases the initial impulse of an decrease of the Element "Foreign exchange rate" leads to an increase of the Element "Liquidity of banks". For a detailed list of paths please refer to Appendix 4.

All elements are only involved in positive paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Foreign exchange rate" increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Foreign exchange rate" decreases the "Liquidity of banks".

Paths from Element 28 (Money supply) to Element 3 (Asset price)

Relevance: Action 1-1 "Extension of money supply"

Results: The initial impulse of an increase of the Element "Money supply" leads to an increase of the Element "Asset price" in 69 cases. In 67 cases the initial impulse of an increase of the Element "Money supply" leads to a decrease of the Element "Asset price" 1.5% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 11.7 for positive paths and 12.0 for negative paths. The median is 12.0 for both. The spread of the lengths of positive paths is greater. Figure 5-98 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

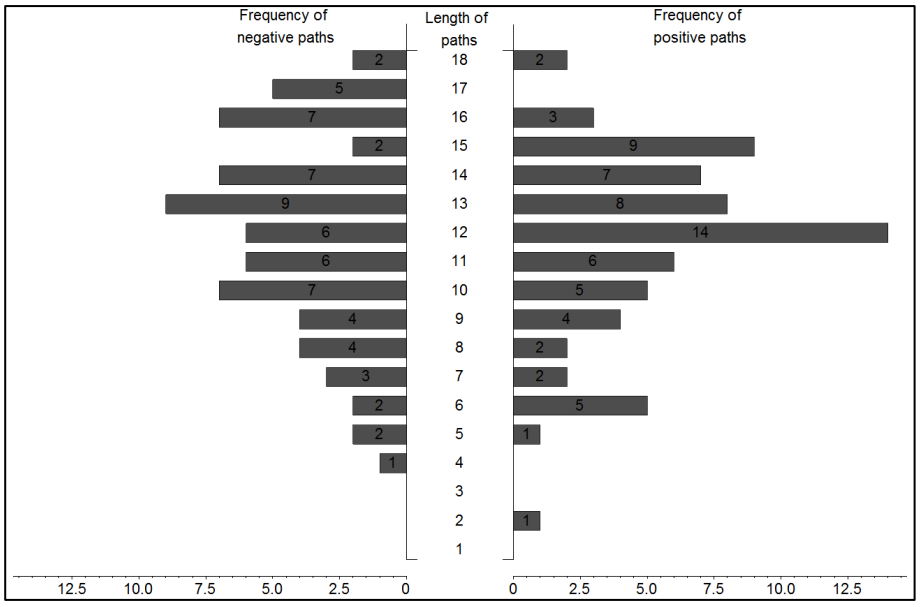


Figure 5-98: Length of paths from Element 28 to Element 3 (from Element "Money supply" to Element "Asset price")

Next to other elements, the Element "Risk of contagion" is directly related and, therefore, more often involved in paths from Element 28 to Element 3. Elements are equally involved in positive and negative paths. Figure 5-99 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

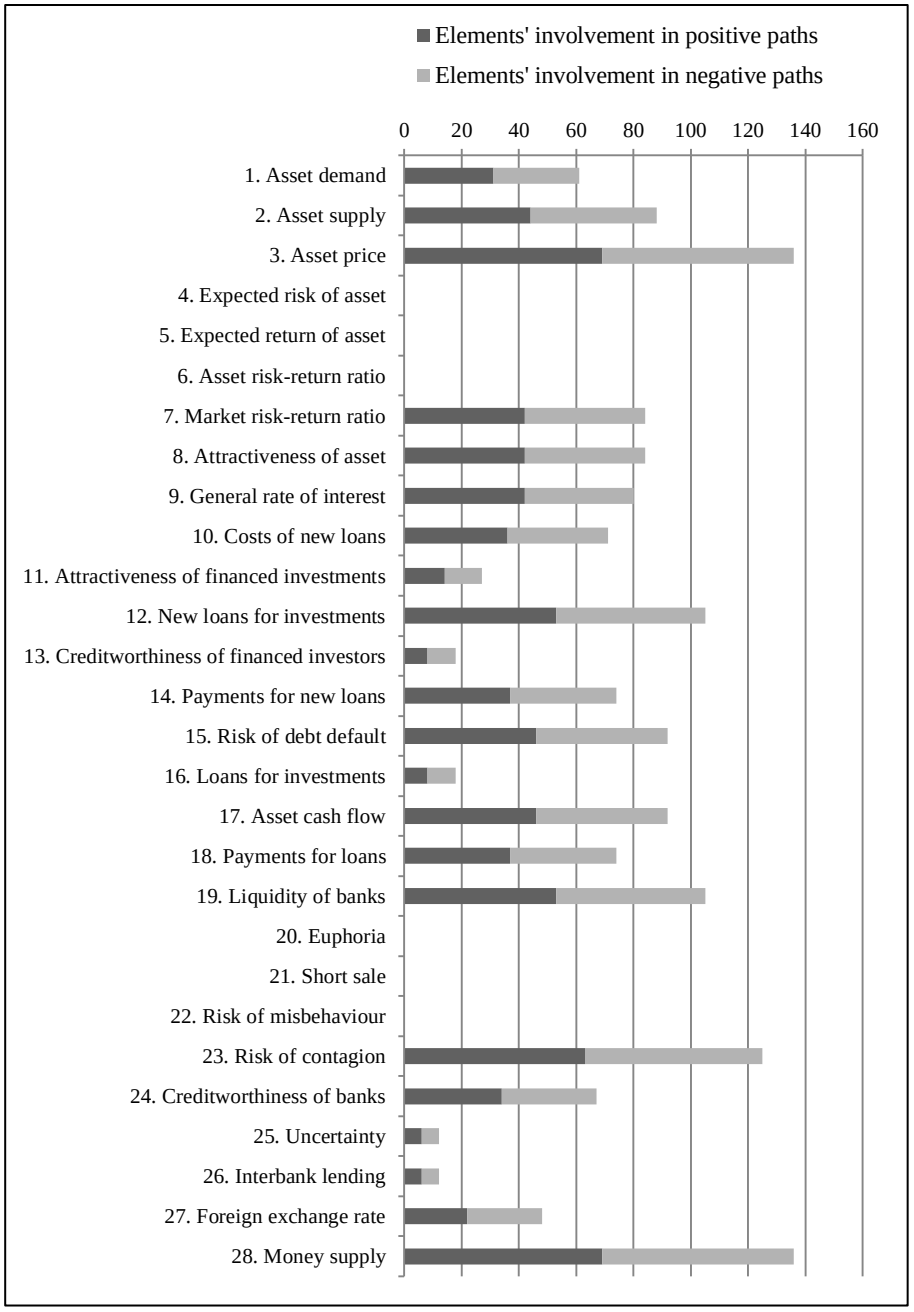


Figure 5-99: Involvement of elements in paths from Element 28 to Element 3 (from Element "Money supply" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Money supply" slightly increases the Element "Asset price".

Paths from Element 28 (Money supply) to Element 19 (Liquidity of banks)

Relevance: Action 1-1 "Extension of money supply"

Results: The initial impulse of an increase of the Element "Money supply" leads to an increase of the Element "Liquidity of banks" in 235 cases. In 220 cases the initial impulse of an increase of the Element "Money supply" leads to a decrease of the Element "Liquidity of banks". 3.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.0 for positive paths and 14.2 for negative paths. The median is 14.0 for both. The spreads of the lengths are identical for positive and negative paths. Figure 5-100 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

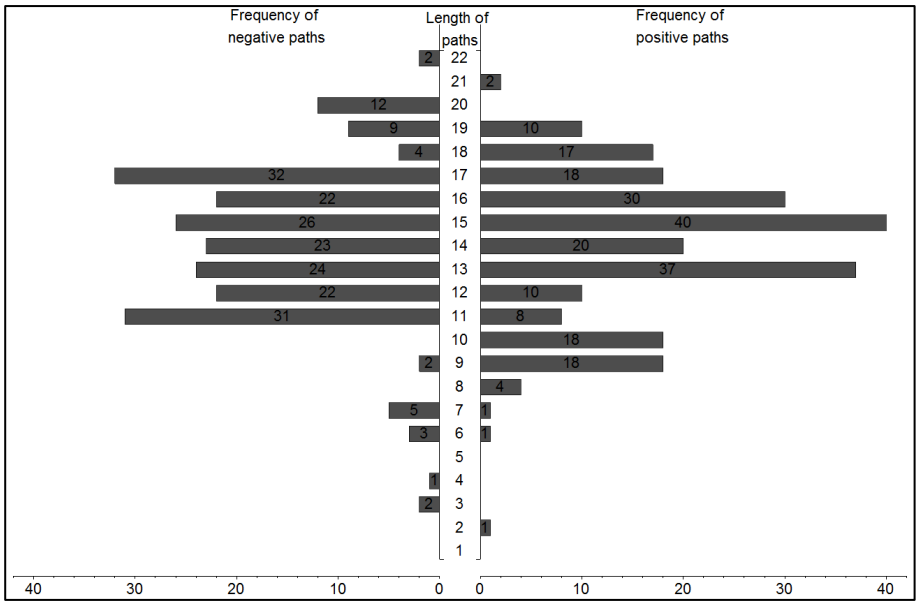


Figure 5-100: Length of paths from Element 28 to Element 19 (from Element "Money supply" to Element "Liquidity of banks")

Next to other elements, the Element "Asset price" is directly related and, therefore, more often involved in paths from Element 28 to Element 19. Elements are equally involved in positive and negative paths. Figure 5-101 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

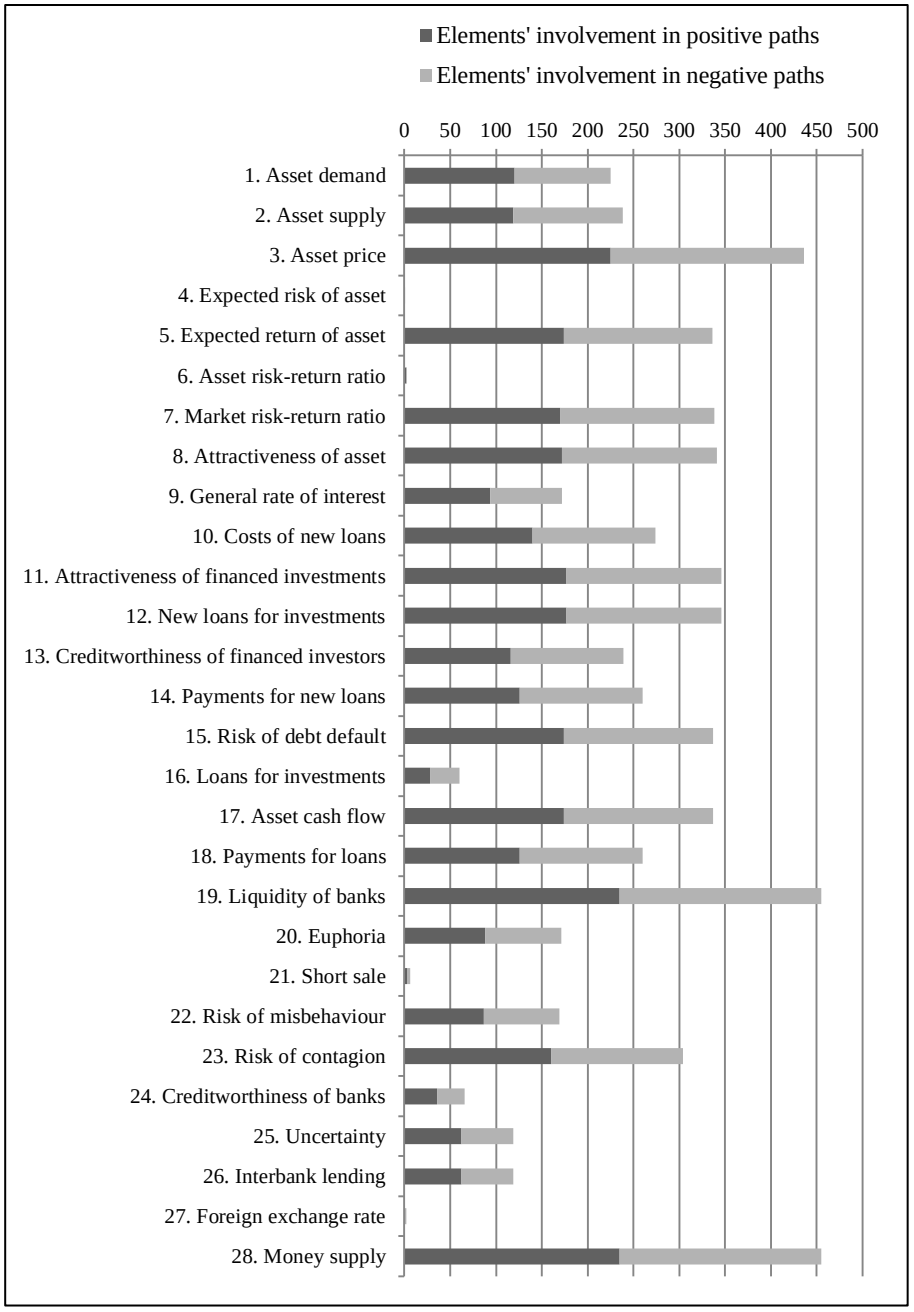


Figure 5-101: Involvement of elements in paths from Element 28 to Element 19 (from Element "Money supply" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Money supply" slightly increases the Element "Liquidity of banks".

Paths from Element 28 (Money supply) to Element 27 (Foreign exchange rate)

Relevance: Action 1-1 "Extension of money supply"

Results: The initial impulse of an increase of the Element "Money supply" leads to an increase of the Element "Foreign exchange rate" in 0 cases. In 2 cases the initial impulse of an increase of the Element "Money supply" leads to a decrease of the Element "Foreign exchange rate". For a detailed list of paths please refer to Appendix 4.

Elements are only involved in negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Money supply" reduces the Element "Foreign exchange rate".

Summary of results

The impact of actions can be measured by identifying effects caused by positive or negative paths to specific elements. The background is described in Chapter 3.3.4. The results of the analyses are summarised in Table 5-5. The table shows, for each identified action, their linked element in the system and their impact on key indicators, including overall number of paths, the number of positive paths and the number of negative paths.

The majority of actions are capable of increasing asset prices: [#1-1, #1-3, #1-6, #2-2, #3-4, #3-7, #3-8, #3-9] or do not have any effect on asset prices: [#1-4, #1-5, #1-7, #2-1, #2-3, #3-2, #3-6]. Only a few actions decrease asset prices: [#1-2, #1-8, #3-1, #3-3, #3-5].

Almost all actions are adequate to increase the liquidity of banks. Only the actions "Increasing of general interest rate" [#1-2], "Depreciation of domestic currency" [#1-5] and "Asset purchases from markets" [#1-6] decrease the liquidity of banks. The action "Debt moratoria for financed investors" [#3-4] does not have a specific effect on the liquidity of banks.

Almost all actions decrease the foreign exchange rate. Only the actions "Increasing of general interest rate" [#1-2], "Appreciation of domestic currency" [#1-4], "Asset purchases from markets" [#1-6] and "Debt moratoria for financed investors" [#3-4] increase the

foreign exchange rate. The actions "Bank holidays on exchanges" [#3-7] and "Prohibition of short sales" [#3-9] neither increase nor decrease the foreign exchange rate.

Table 5-5: Summary of the impact of identified actions

#	Action	Element	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
1-1	Extension of money supply	28: Money supply	↗ 136-69-67	↗ 455-235-220	↓ 2-0-2
1-2	Increasing of general interest rate	9: General rate of interest	↘ 157-78-79	↘ 325-156-169	↗ 86-45-41
1-3	Decreasing of general interest rate	9: General rate of interest	↗ 157-78-79	↗ 325-156-169	↘ 86-45-41
1-4	Appreciation of domestic currency	27: Foreign exchange rate	→ 54-27-27	↑ 1-1-0	↑ n/a
1-5	Depreciation of domestic currency	27: Foreign exchange rate	→ 54-27-27	↓ 1-1-0	↓ n/a
1-6	Asset purchases from markets	1: Asset demand	↗[22] 12-6-6	↘ 241-118-123	↗ 78-40-38
1-7	Asset purchases from banks	19: Liquidity of banks	→ 54-27-27	↑ n/a	↘ 90-44-46
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	↓ 19-9-10	↗ 208-108-100	↘ 84-40-44
2-1	Provision of liquidity to banks	19: Liquidity of banks	→ 54-27-27	↑ n/a	↘ 90-44-46
2-2	Provision of liquidity to financed investors	17: Asset cash flow	↗ 73-38-35	↗ 179-92-87	↓ 2-0-2
2-3	Provision of foreign liquidity to banks	19: Liquidity of banks	→ 54-27-27	↑ n/a	↘ 90-44-46
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	↓ 19-9-10	↗ 208-108-100	↘ 84-40-44
3-2	Asset purchase programme	19: Liquidity of banks	→ 54-27-27	↑ n/a	↘ 90-44-46
3-3	Asset transfer programme	24: Creditworthiness of banks	↓ 19-9-10	↗ 208-108-100	↘ 84-40-44
3-4	Debt moratoria for financed investors	18: Payments for loans	↗ 111-54-57	→ 130-65-65	↑ 72-34-38

[22] A difference in the lengths of positive and negative paths causes a deviation of the normal effect.

#	Action	Element	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
3-5	Accounting discretion	24: Creditworthiness of banks	↓ 19-9-10	↗ 208-108-100	↘ 84-40-44
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	→ 54-27-27	↑ n/a	↘ 90-44-46
3-7	Bank holidays on exchanges	3: Asset price	↑ n/a	↗ 136-69-67	→[23] 54-28-26
3-8	Stress tests	25: Uncertainty	↗ 148-72-76	↗ 337-163-174	↓ 2-2-0
3-9	Prohibition of short sales	21: Short sales	↗[23] 13-6-7	↗ 375-184-191	→ 120-60-60

Legend

↑ Significant increase	↗ Slight increase	→ No effect	↘ Slight decrease	↓ Significant decrease

This section showed that just a few actions have exclusively positive effects on the key elements of the developed system. The next section concentrates on the analysis of effects of potential new actions.

[23] A difference in the lengths of positive and negative paths causes a deviation of the normal effect.

5.3.2 Analysis of potential new actions

Paths from Element 2 (Asset supply) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Asset supply" leads to an increase of the Element "Asset price" in 0 cases. In 1 case the initial impulse of an increase of the Element "Asset supply" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Asset supply" leads to a decrease of the Element "Asset price" in 0 cases. In 1 case the initial impulse of a decrease of the Element "Asset supply" leads to an increase of the Element "Asset price".

For a detailed list of paths please refer to Appendix 4.

Interpretation: The initial impulse of increasing the Element "Asset supply" decreases the Element "Asset price".

The initial impulse of decreasing the Element "Asset supply" increases the Element "Asset price".

Paths from Element 2 (Asset supply) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Asset supply" leads to an increase of the Element "Liquidity of banks" in 67 cases. In 69 cases the initial impulse of an increase of the Element "Asset supply" leads to a decrease of the Element "Liquidity of banks".
The initial impulse of a decrease of the Element "Asset supply" leads to a decrease of the Element "Liquidity of banks" in 67 cases. In 69 cases the initial impulse of a decrease of the Element "Asset supply" leads to an increase of the Element "Liquidity of banks".
1.5% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 13.5

for positive paths and 13.2 for negative paths. The median is 13.0 for positive paths and 12.0 for negative paths. The spreads of the lengths are identical for positive and negative paths. Figure 5-102 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

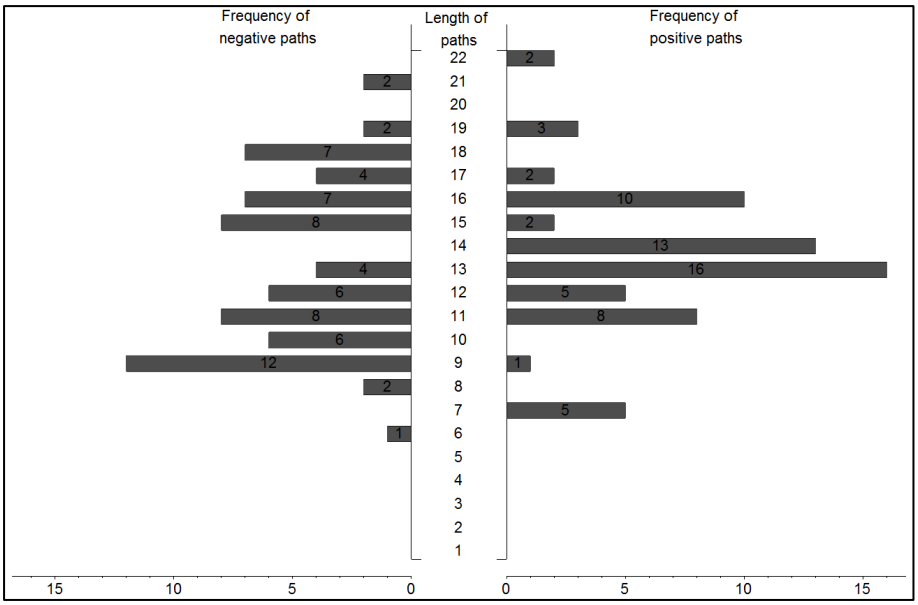


Figure 5-102: Length of paths from Element 2 to Element 19 (from Element "Asset supply" to Element "Liquidity of banks")

The Element "Asset price" is directly related and, therefore, more often involved in paths from Element 2 to Element 19. Indirectly, the Elements "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Asset demand and "Risk of contagion" are more often involved in negative paths. Figure 5-103 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

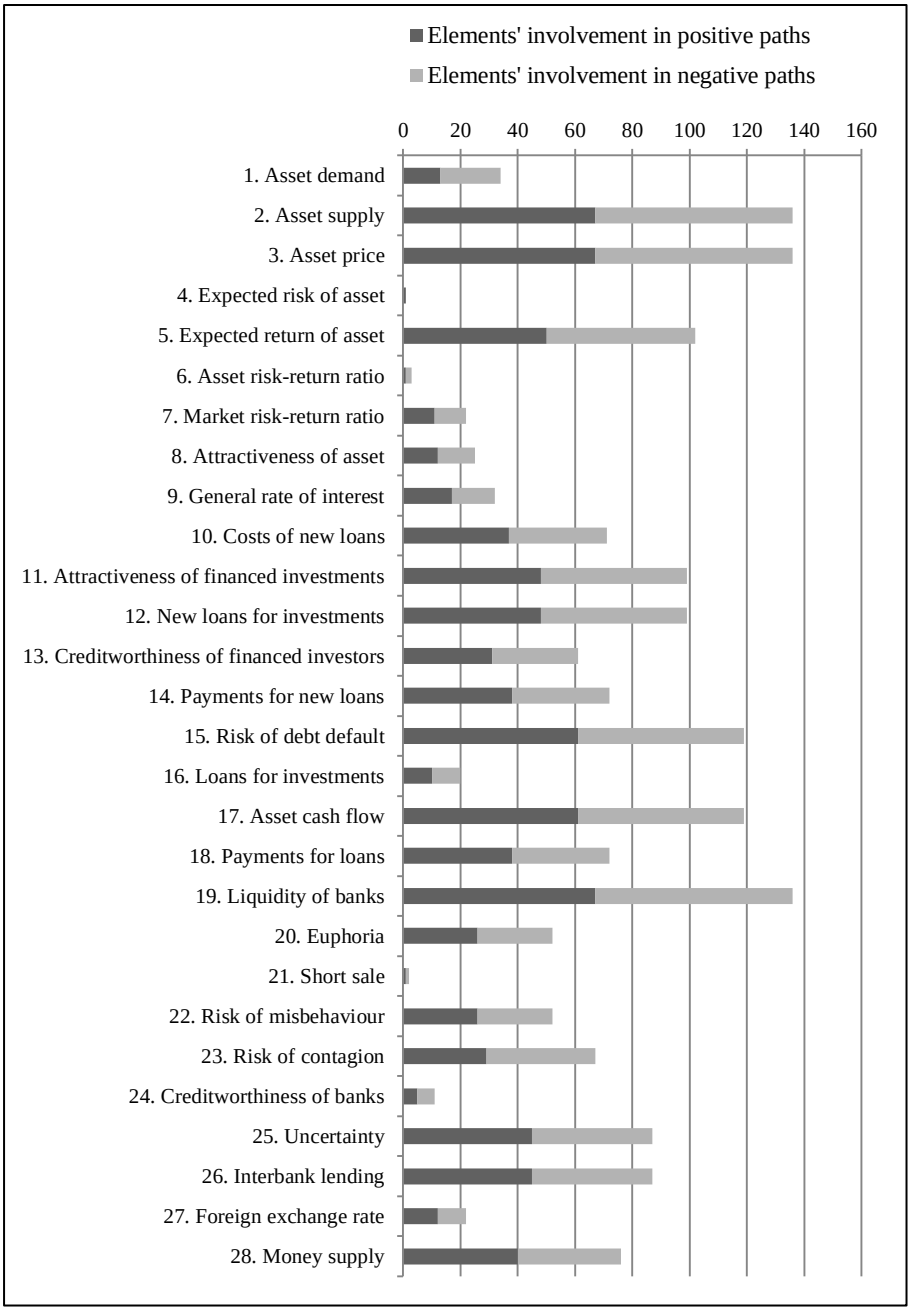


Figure 5-103: Involvement of elements in paths from Element 2 to Element 19 (from Element "Asset supply" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Asset supply" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Asset supply" slightly increases the Element "Liquidity of banks".

Paths from Element 2 (Asset supply) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Asset supply" leads to an increase of the Element "Foreign exchange rate" in 26 cases. In 28 cases the initial impulse of an increase of the Element "Asset supply" leads to a decrease of the Element "Foreign exchange rate".
The initial impulse of a decrease of the Element "Asset supply" leads to a decrease of the Element "Foreign exchange rate" in 26 cases. In 28 cases the initial impulse of a decrease of the Element "Asset supply" leads to an increase of the Element "Foreign exchange rate".
3.7% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 14.9 for positive paths and 17.0 for negative paths. The median is 13.5 for positive paths and 17.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-104 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

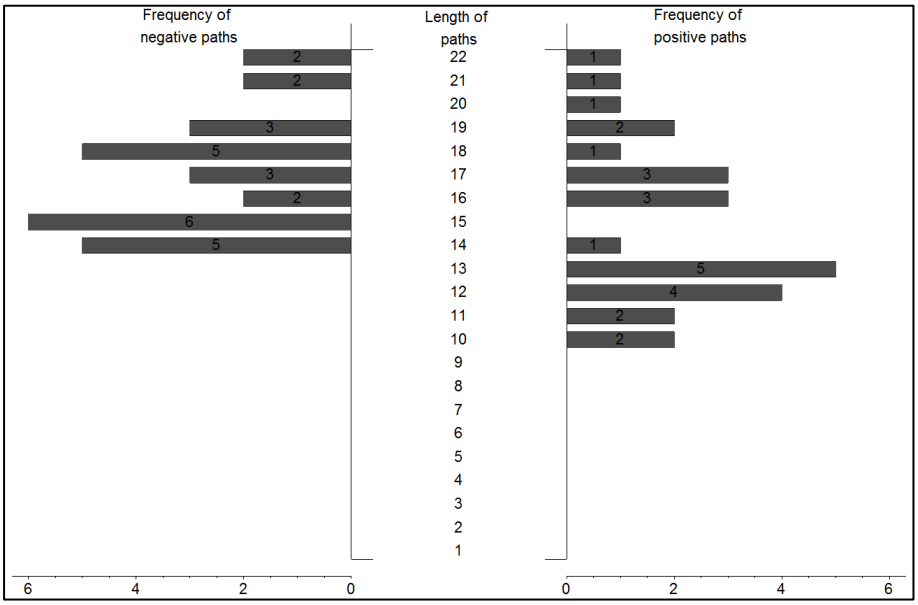


Figure 5-104: Length of paths from Element 2 to Element 27 (from Element "Asset supply" to Element "Foreign exchange rate")

The Element "Asset price" is directly related and, therefore, more often involved in paths from Element 2 to Element 27. Indirectly, the

Elements “New loans for investments”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “New loans for investments”, “Payments for new loans”, “Payments for loans” and “Liquidity of banks” are more often involved in negative paths. Figure 5-105 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

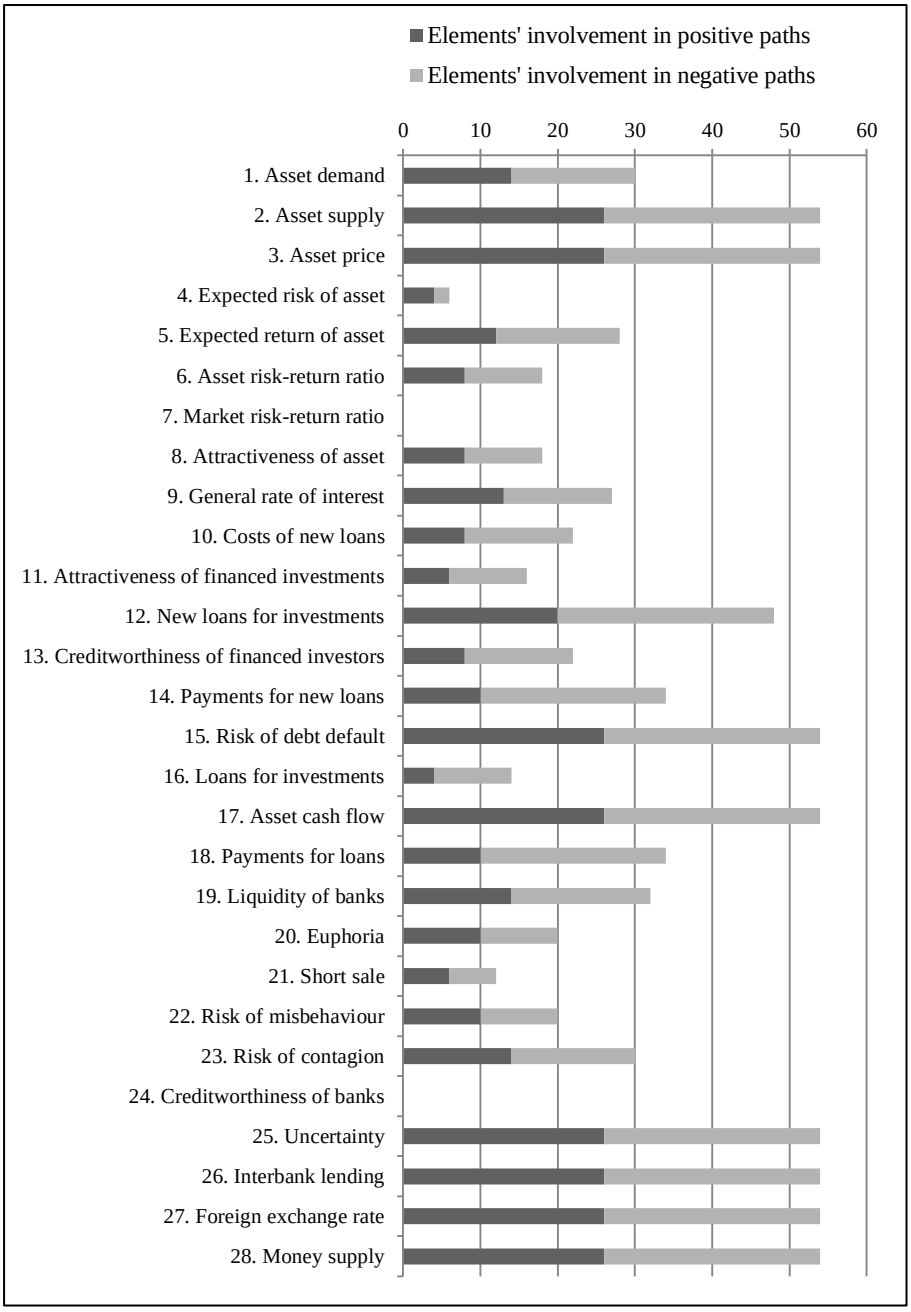


Figure 5-105: Involvement of elements in paths from Element 2 to Element 27 (from Element "Asset supply" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Asset supply" slightly reduces the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of increasing the Element "Asset supply" neither increases nor decreases

the Element “Foreign exchange rate”.

The initial impulse of decreasing the Element “Asset supply” slightly increases the Element “Foreign exchange rate” according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of decreasing the Element “Asset supply” neither increases nor decreases the Element “Foreign exchange rate”.

Paths from Element 4 (Expected risk of asset) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element “Expected risk of asset” leads to an increase of the Element “Asset price” in 2 cases. In 4 cases the initial impulse of an increase of the Element “Expected risk of asset” leads to a decrease of the Element “Asset price”.

The initial impulse of a decrease of the Element “Expected risk of asset” leads to a decrease of the Element “Asset price” in 2 cases. In 4 cases the initial impulse of a decrease of the Element “Expected risk of asset” leads to an increase of the Element “Asset price”.

33.3% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 16.5 for positive paths and 7.5 for negative paths. The median is 16.5 for positive paths and 6.0 for negative paths. The spread of the lengths of negative paths is greater. For a detailed list of paths please refer to Appendix 5.

The Element “Asset risk-return ratio” is directly related and, therefore, more often involved in paths from Element 4 to Element 3. Indirectly, the Elements “Asset demand”, “Asset risk-return ratio” and “Attractiveness of asset” play significant roles. Elements are equally involved in positive and negative paths. For a detailed list of numbers

please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Expected risk of asset" decreases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of increasing the Element "Expected risk of asset" decreases the Element "Asset price".

The initial impulse of decreasing the Element "Expected risk of asset" increases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Expected risk of asset" increases the Element "Asset price".

Paths from Element 4 (Expected risk of asset) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Expected risk of asset" leads to an increase of the Element "Liquidity of banks" in 147 cases. In 136 cases the initial impulse of an increase of the Element "Expected risk of asset" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Expected risk of asset" leads to a decrease of the Element "Liquidity of banks" in 147 cases. In 136 cases the initial impulse of a decrease of the Element "Expected risk of asset" leads to an increase of the Element "Liquidity of banks".

3.9% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative

paths are equalised by longer negative paths. The mean is 16.4 for positive paths and 16.0 for negative paths. The median is 16.0 for positive paths and 15.0 for negative paths. The spread of negative paths is greater. In general, elements are equally involved in positive and negative paths. Figure 5-106 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

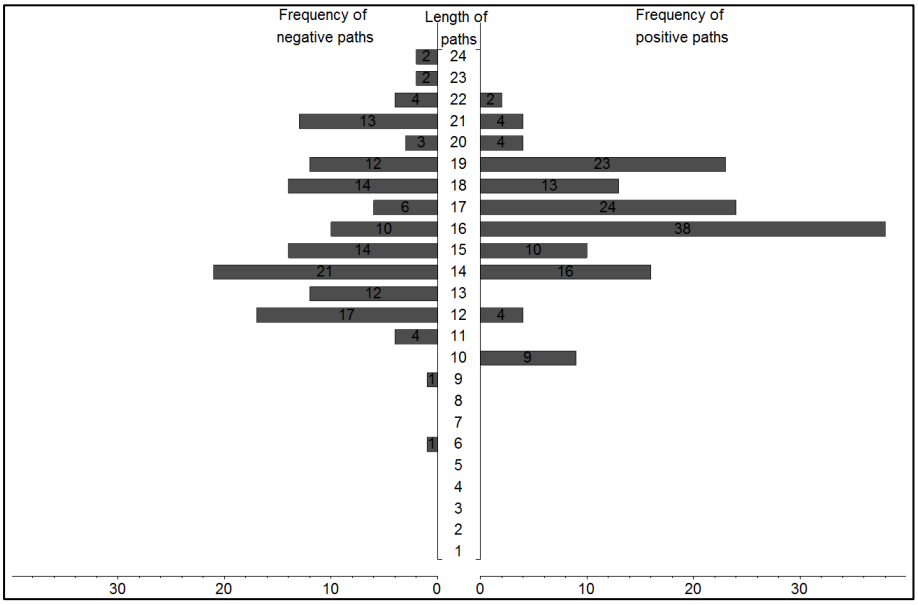


Figure 5-106: Length of paths from Element 4 to Element 19 (from Element "Expected risk of asset" to Element "Liquidity of banks")

The Element "Asset risk-return ratio" is directly related and, therefore, more often involved in paths from Element 4 to Element 19. Indirectly, the Elements "Asset price", "Attractiveness of asset", "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest", "Costs of new loans" and "Money supply" are more often involved in positive paths. Figure 5-107 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

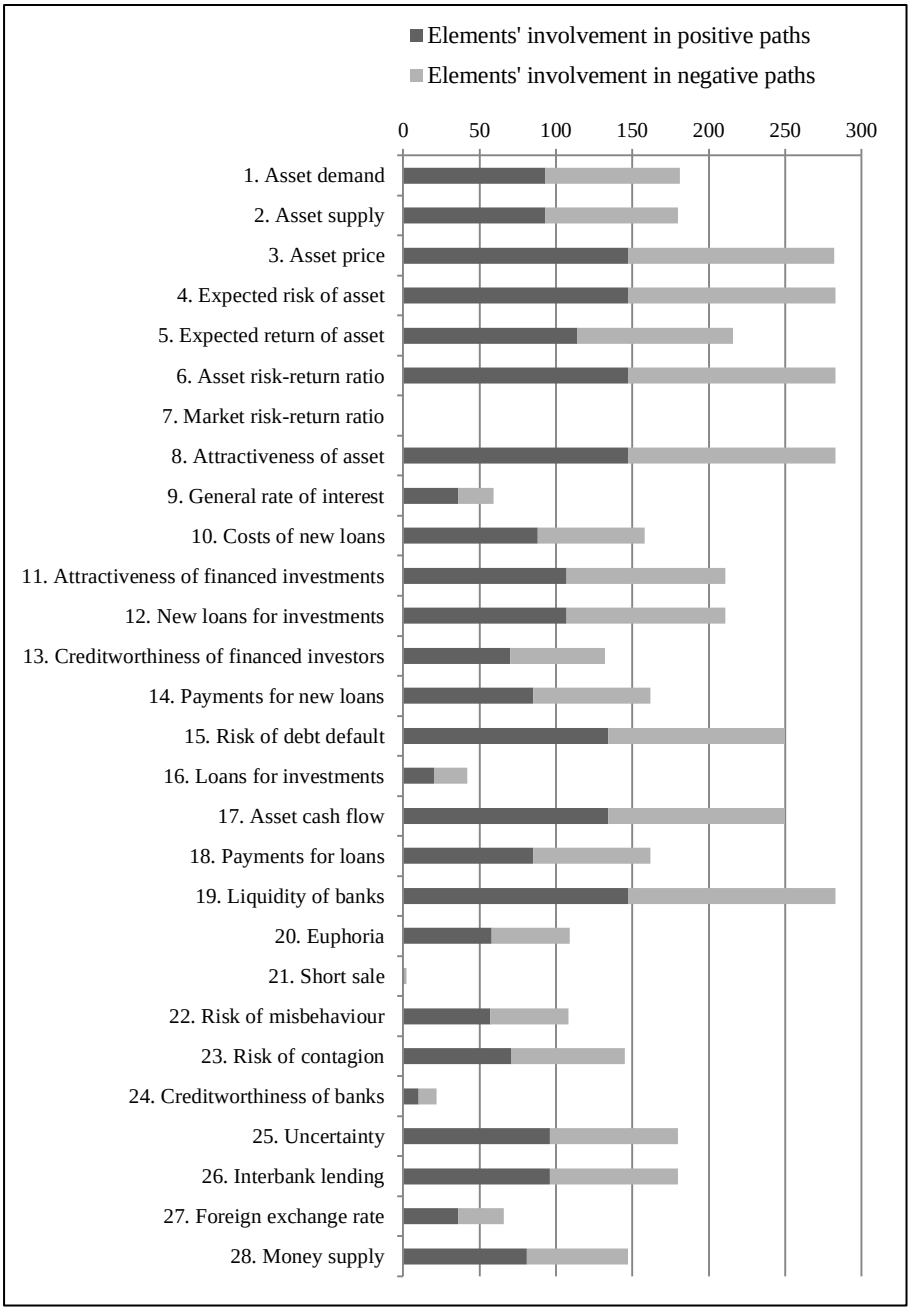


Figure 5-107: Involvement of elements in paths from Element 4 to Element 19 (from Element "Expected risk of asset" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Expected risk of asset" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Expected risk of asset" slightly decreases the Element "Liquidity of banks".

Paths from Element 4 (Expected risk of asset) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Expected risk of asset" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 46 cases the initial impulse of an increase of the Element "Expected risk of asset" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Expected risk of asset" leads to a decrease of the Element "Foreign exchange rate" in 44 cases. In 46 cases the initial impulse of a decrease of the Element "Expected risk of asset" leads to an increase of the Element "Foreign exchange rate".

2.2% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 16.0 for positive paths and 19.0 for negative paths. The median is 16.0 for positive paths and 19.0 for negative paths. The spread of the lengths is higher for positive paths. Figure 5-108 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

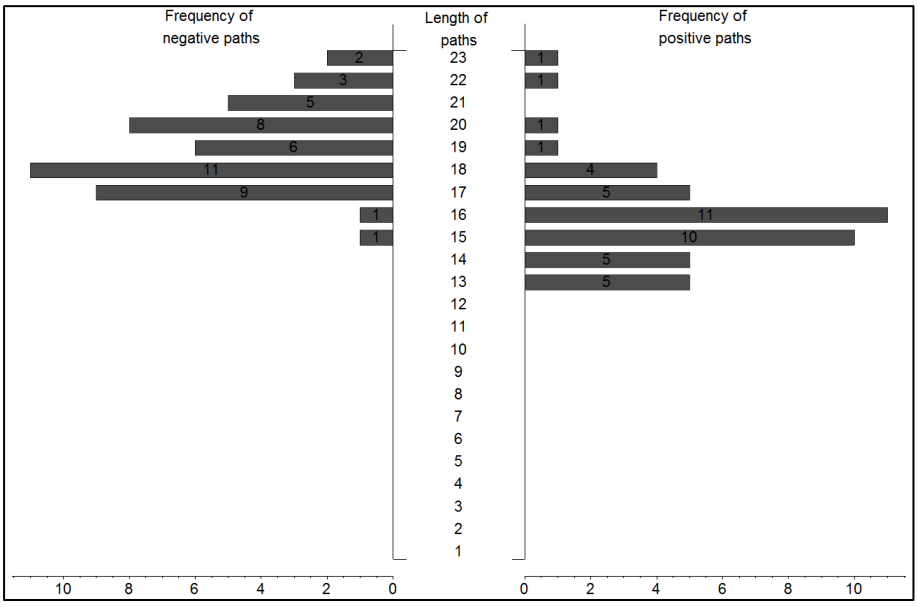


Figure 5-108: Length of paths from Element 4 to Element 27 (from Element "Expected risk of asset" to Element "Foreign exchange rate")

The Element “Asset risk-return ratio” is directly related and, therefore, more often involved in paths from Element 4 to Element 27. Indirectly, the Elements “Asset price”, “Attractiveness of asset”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Costs of new loans“, “Attractiveness of financed investments“, “New loans for investments”, “Creditworthiness of financed investors”, “Payments for new loans” and “Payments for loans” are more often involved in negative paths. Figure 5-109 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

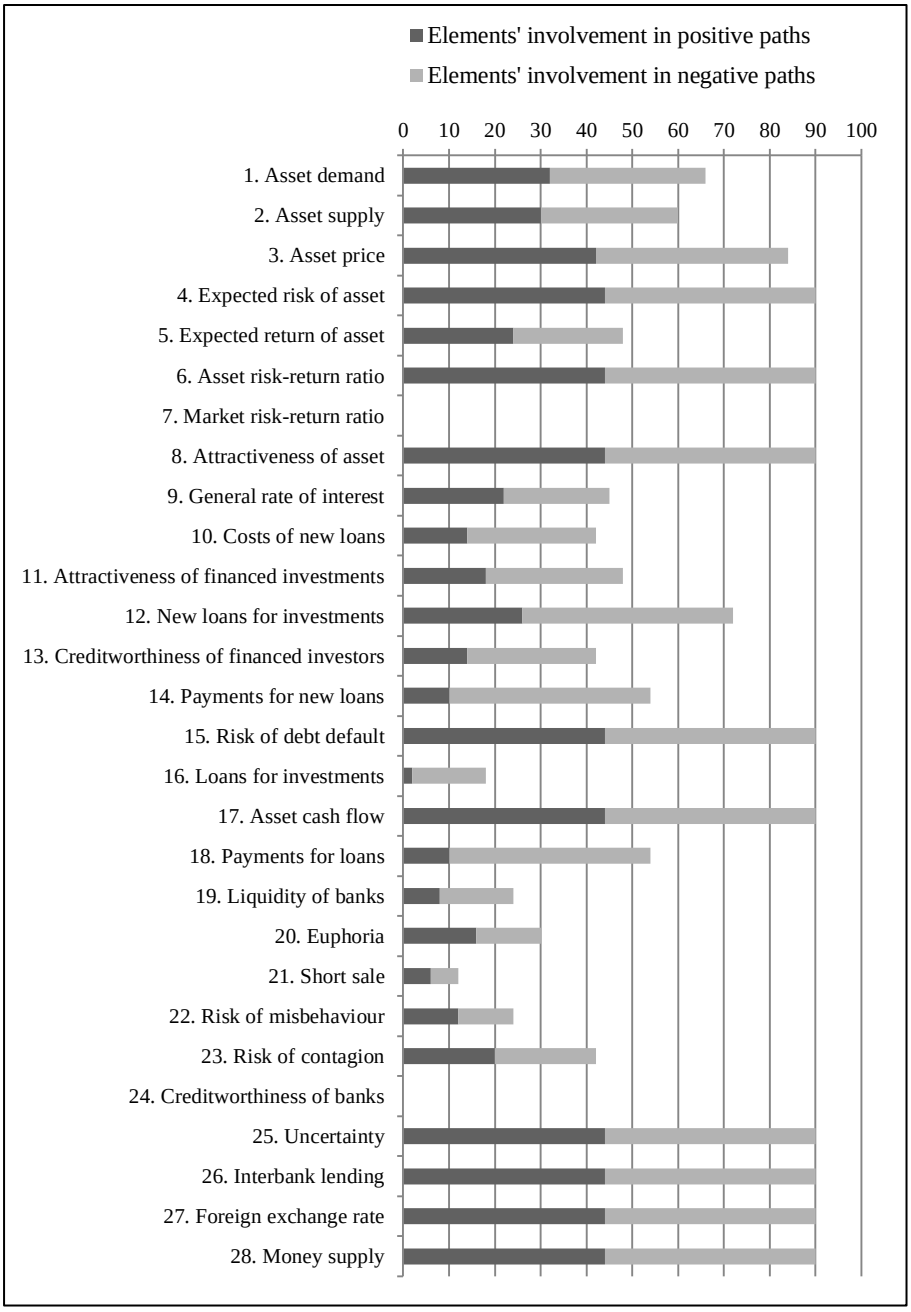


Figure 5-109: Involvement of elements in paths from Element 4 to Element 27 (from Element "Expected risk of asset" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Expected risk of asset" slightly reduces the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of increasing the Element "Expected risk of asset" neither

increases nor decreases the Element “Foreign exchange rate”.

The initial impulse of decreasing of the Element “Expected risk of asset” slightly increases the Element “Foreign exchange rate” according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of decreasing the Element “Expected risk of asset” neither increases nor decreases the Element “Foreign exchange rate”.

Paths from Element 5 (Expected return of asset) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element “Expected return of asset” leads to an increase of the Element “Asset price” in 94 cases. In 87 cases the initial impulse of an increase of the Element “Expected return of asset” leads to a decrease of the Element “Asset price”.
The initial impulse of a decrease of the Element “Expected return of asset” leads to a decrease of the Element “Asset price” in 94 cases. In 87 cases the initial impulse of a decrease of the Element “Expected return of asset” leads to an increase of the Element “Asset price”.
3.9% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The length of positive paths and negative paths is similar. The mean is 13.5 for positive paths and 14.0 for negative paths. The median is 14.0 for both. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-110 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

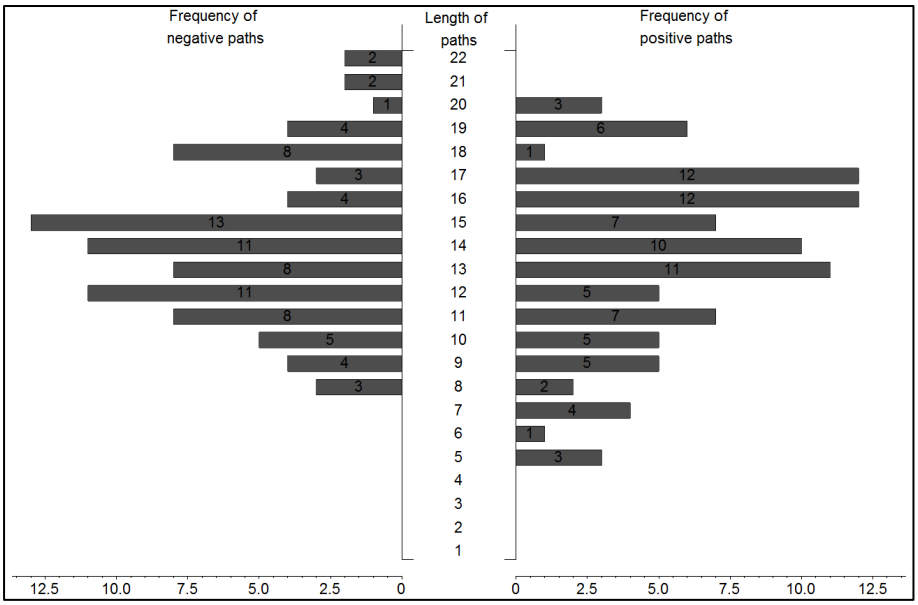


Figure 5-110: Length of paths from Element 5 to Element 3 (from Element "Expected return of asset" to Element "Asset price")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 5 to Element 3. Indirectly, the Element "Risk of debt default" plays a significant role. Elements are equally involved in positive and negative paths. Figure 5-111 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

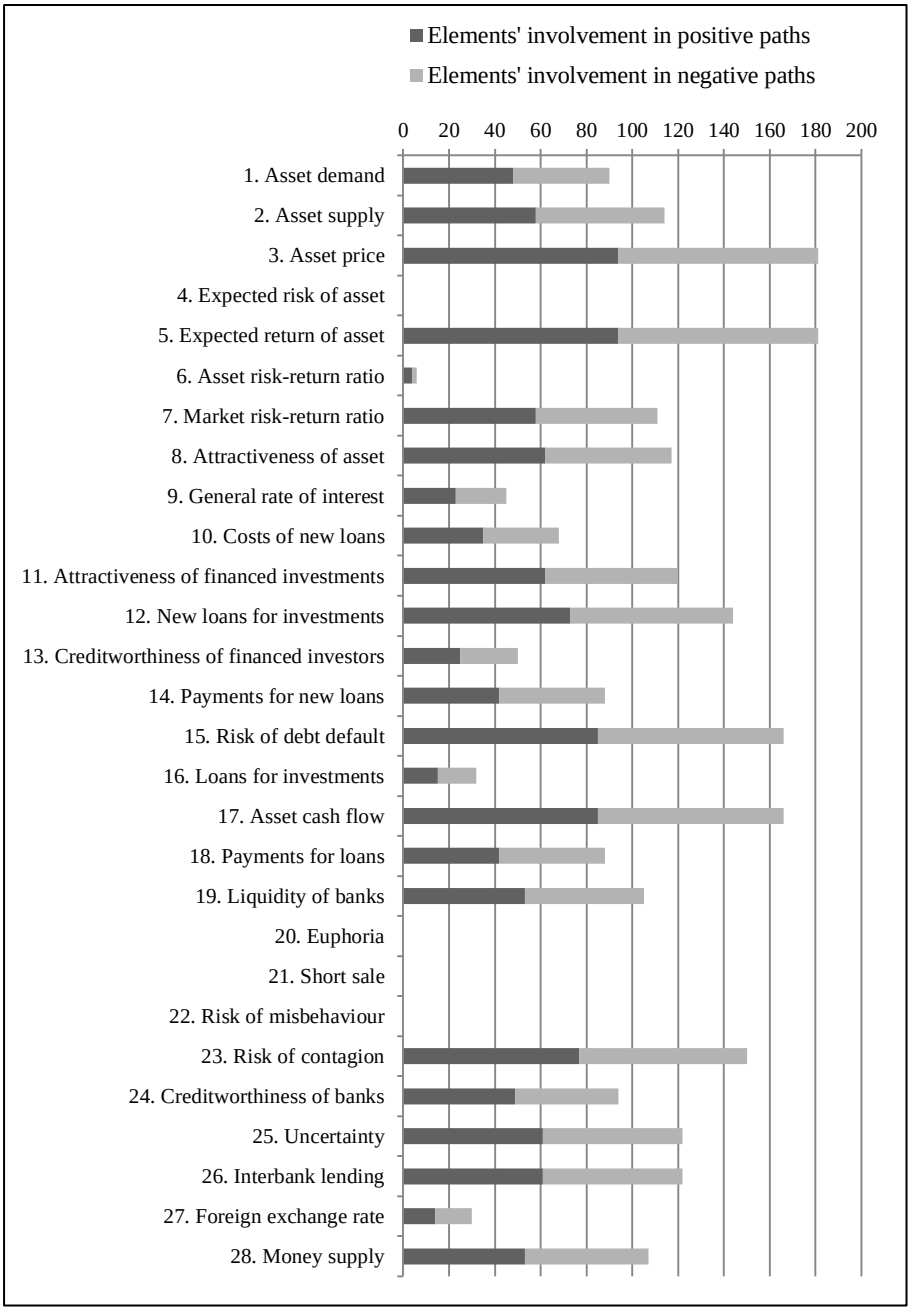


Figure 5-111: Involvement of elements in paths from Element 5 to Element 3 (from Element "Expected return of asset" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Expected return of asset" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Expected return of asset" slightly decreases the Element "Asset price".

Paths from Element 5 (Expected return of asset) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Expected return of asset" leads to an increase of the Element "Liquidity of banks" in 116 cases. In 114 cases the initial impulse of an increase of the Element "Expected return of asset" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Expected return of asset" leads to a decrease of the Element "Liquidity of banks" in 116 cases. In 114 cases the initial impulse of a decrease of the Element "Expected return of asset" leads to an increase of the Element "Liquidity of banks".

0.9% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.5 for positive paths and 14.7 for negative paths. The median is 14.5 for positive paths and 16.0 for negative paths. The spreads of the lengths of positive paths and negative paths are identical. Figure 5-112 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

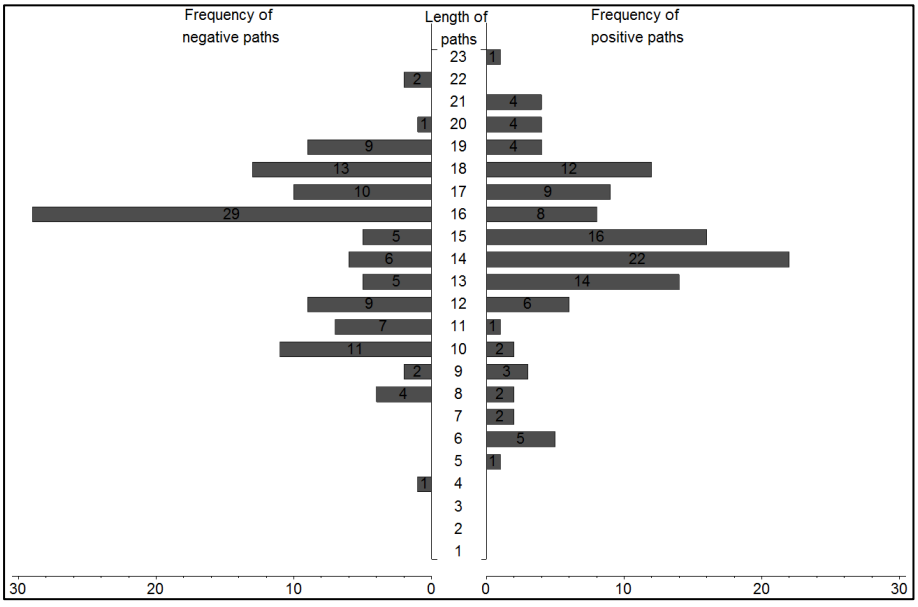


Figure 5-112: Length of paths from Element 5 to Element 19 (from Element "Expected return of asset" to Element "Liquidity of banks")

Next to other elements, the Element “Asset cash flow” is directly related and, therefore, more often involved in paths from Element 5 to Element 19. Indirectly, the Element “Risk of debt default” plays a significant role. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “General rate of interest“ and “Foreign exchange rate” are more often involved in negative paths. Figure 5-113 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

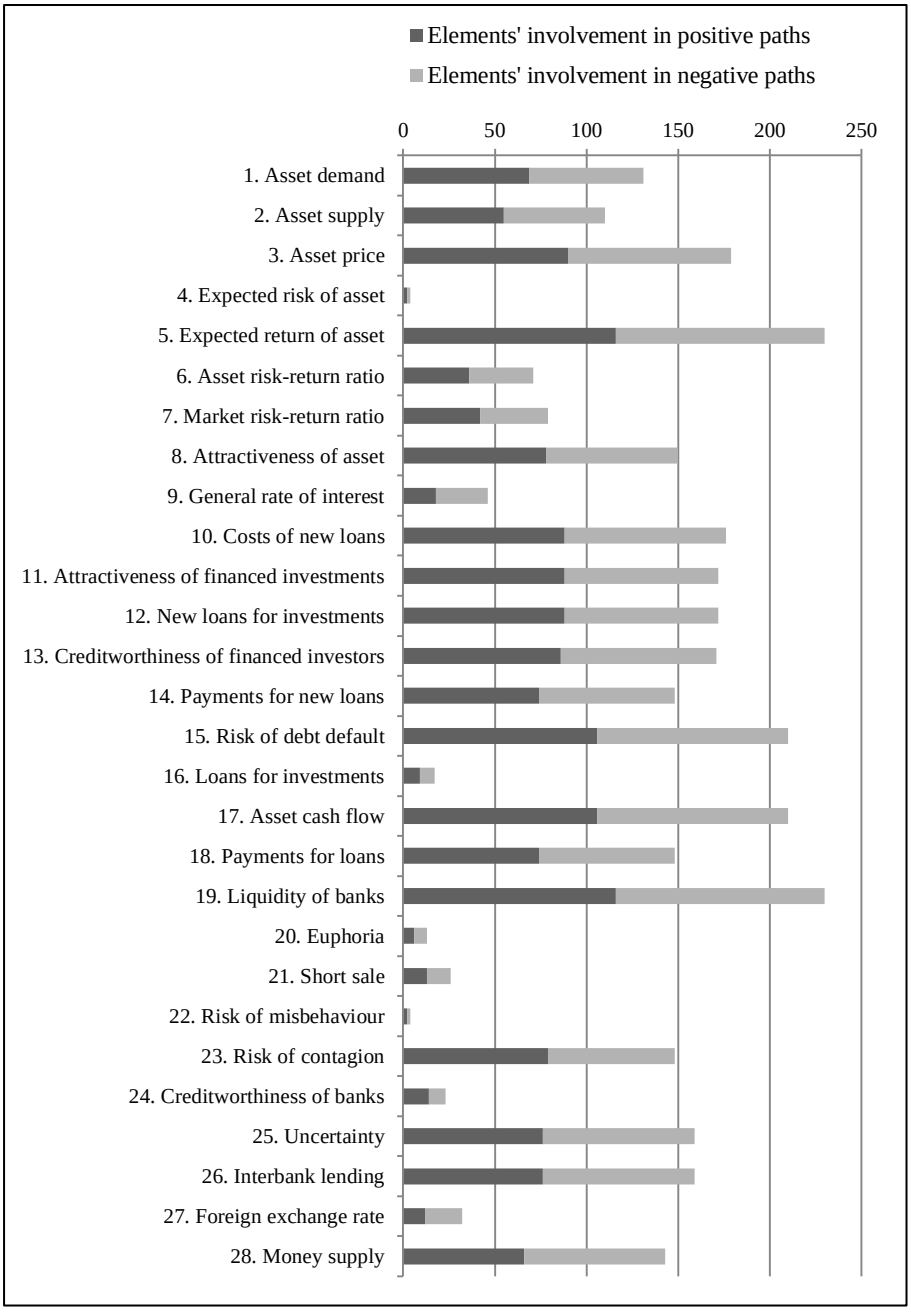


Figure 5-113: Involvement of elements in paths from Element 5 to Element 19 (from Element "Expected return of asset" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Expected return of asset" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Expected return of asset" slightly decreases the Element "Liquidity of banks".

Paths from Element 5 (Expected return of asset) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Expected return of asset" leads to an increase of the Element "Foreign exchange rate" in 30 cases. In 32 cases the initial impulse of an increase of the Element "Expected return of asset" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Expected return of asset" leads to a decrease of the Element "Foreign exchange rate" in 30 cases. In 32 cases the initial impulse of a decrease of the Element "Expected return of asset" leads to an increase of the Element "Foreign exchange rate".

3.2% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 17.6 for positive paths and 16.3 for negative paths. The median is 18.0 for positive paths and 16.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-114 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

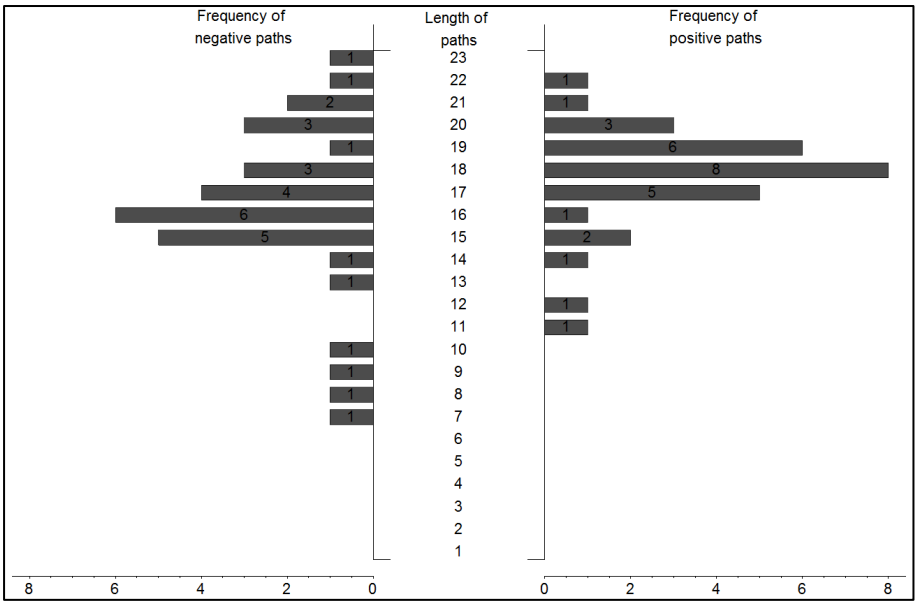


Figure 5-114: Length of paths from Element 5 to Element 27 (from Element "Expected return of asset" to Element "Foreign exchange rate")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 5 to Element 27. Indirectly, the Elements "New loans for investments", "Risk of debt default", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "New loans for investments", "Payments for new loans" and "Payments for loans" are more often involved in positive paths. Figure 5-115 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

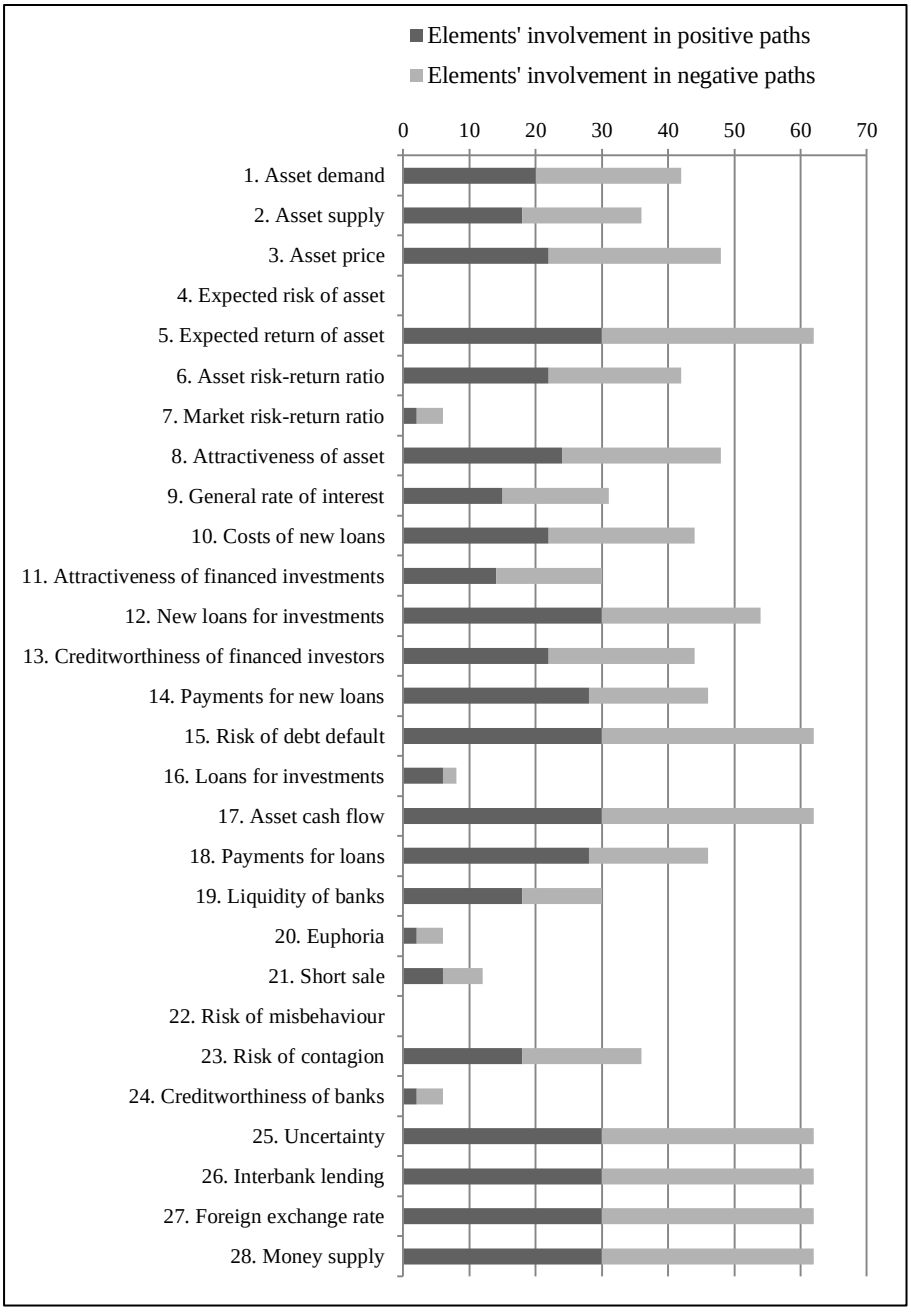


Figure 5-115: Involvement of elements in paths from Element 5 to Element 27 (from Element "Expected return of asset" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Expected return of asset" slightly reduces the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Expected return of asset" slightly increases the Element "Foreign exchange rate".

Paths from Element 6 (Asset risk-return ratio) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Asset risk-return ratio" leads to an increase of the Element "Asset price" in 4 cases. In 2 cases the initial impulse of an increase of the Element "Asset risk-return ratio" leads to a decrease of the Element "Asset price".
The initial impulse of a decrease of the Element "Asset risk-return ratio" leads to a decrease of the Element "Asset price" in 4 cases. In 2 cases the initial impulse of a decrease of the Element "Asset risk-return ratio" leads to an increase of the Element "Asset price".
33.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 6.5 for positive paths and 15.5 for negative paths. The median is 5.0 for positive paths and 15.5 for negative paths. For a detailed list of numbers please refer to Appendix 5.

The Element "Attractiveness of asset" is directly related and, therefore, more often involved in paths from Element 6 to Element 3. Indirectly, the Element "Asset demand" plays a significant role. Elements are equally involved in positive and negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Asset risk-return ratio" increases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of positive paths is shorter than the length of negative paths, which intensives the effects of positive paths. Therefore, it is assumed that the initial impulse of increasing the Element "Asset risk-return ratio" increases the Element "Asset price".

The initial impulse of decreasing the Element "Asset risk-return ratio" decreases the Element "Asset price" according to the number of

positive and negative paths. In addition, the length of positive paths is shorter than the length of negative paths, which intensives the effects of positive paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Asset risk-return ratio" decreases the Element "Asset price".

Paths from Element 6 (Asset risk-return ratio) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Asset risk-return ratio" leads to an increase of the Element "Liquidity of banks" in 136 cases. In 147 cases the initial impulse of an increase of the Element "Asset risk-return ratio" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Asset risk-return ratio" leads to a decrease of the Element "Liquidity of banks" in 136 cases. In 147 cases the initial impulse of a decrease of the Element "Asset risk-return ratio" leads to an increase of the Element "Liquidity of banks".

3.9% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter positive paths are equalised by longer positive paths. The mean is 15.0 for positive paths and 15.4 for negative paths. The median is 14.0 for positive paths and 15.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-116 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

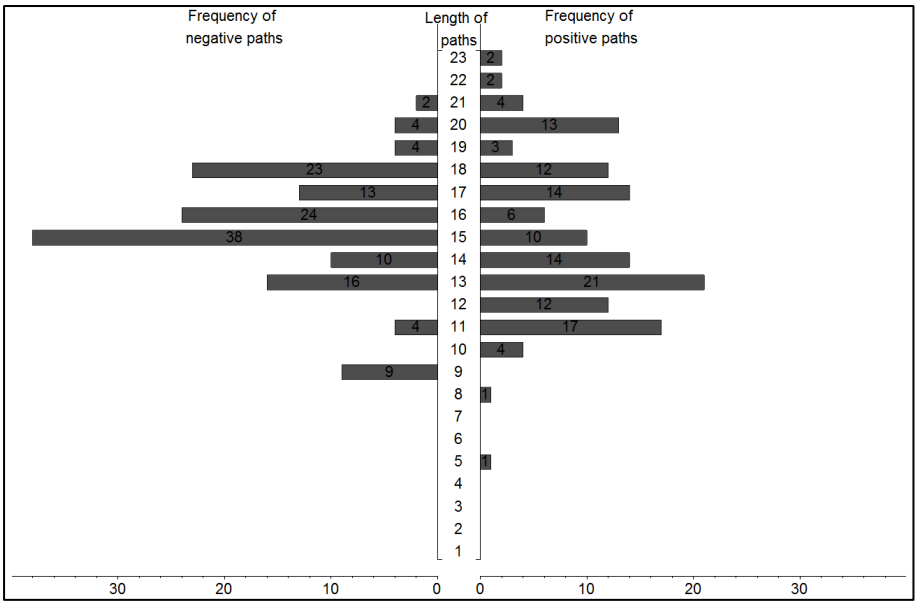


Figure 5-116: Length of paths from Element 6 to Element 19 (from Element "Asset risk-return ratio" to Element "Liquidity of banks")

The Element "Attractiveness of asset" is directly related and, therefore, more often involved in paths from Element 6 to Element 19. Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest", "Costs of new loans" and "Money supply" are more often involved in negative paths. Figure 5-117 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

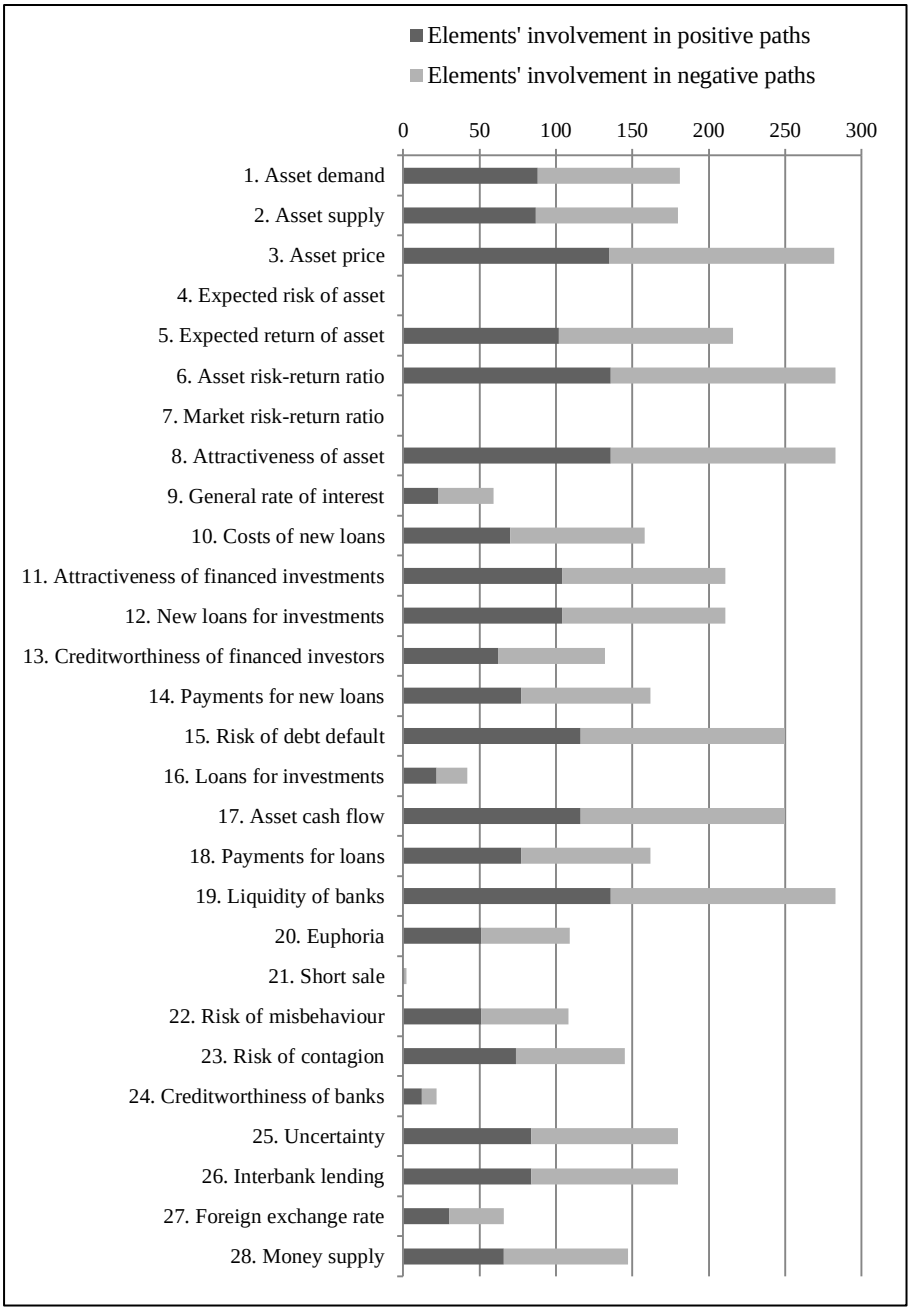


Figure 5-117: Involvement of elements in paths from Element 6 to Element 19 (from Element "Asset risk-return ratio" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Asset risk-return ratio" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Asset risk-return ratio" slightly increases the Element "Liquidity of banks".

Paths from Element 6 (Asset risk-return ratio) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Asset risk-return ratio" leads to an increase of the Element "Foreign exchange rate" in 46 cases. In 44 cases the initial impulse of an increase of the Element "Asset risk-return ratio" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Asset risk-return ratio" leads to a decrease of the Element "Foreign exchange rate" in 46 cases. In 44 cases the initial impulse of a decrease of the Element "Asset risk-return ratio" leads to an increase of the Element "Foreign exchange rate".

2.2% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 18.0 for positive paths and 15.0 for negative paths. The median is 18.0 for positive paths and 15.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-118 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

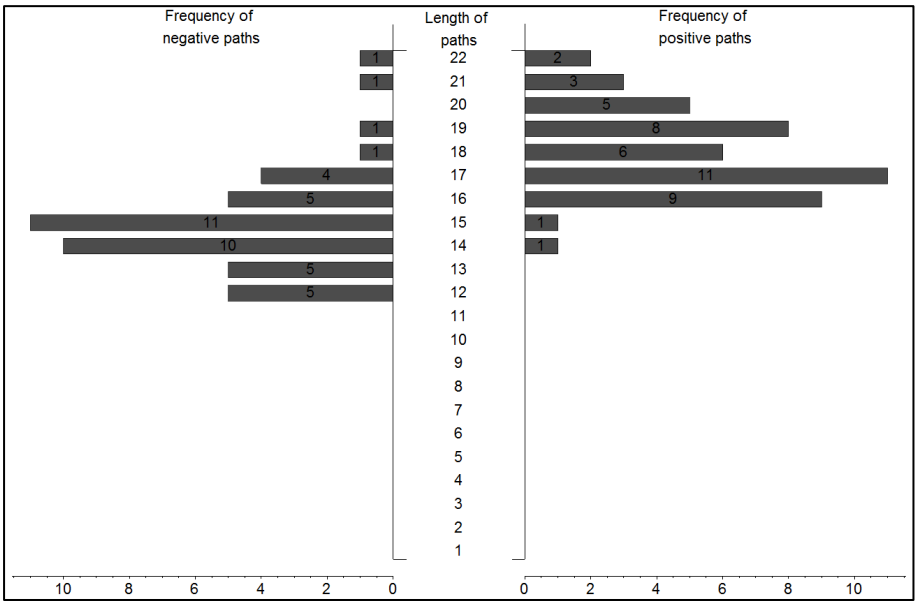


Figure 5-118: Length of paths from Element 6 to Element 27 (from Element "Asset risk-return ratio" to Element "Foreign exchange rate")

The Element “Attractiveness of asset” is directly related and, therefore, more often involved in paths from Element 6 to Element 27. Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Costs of new loans“, “Attractiveness of financed investments“, “New loans for investments”, “Creditworthiness of financed investors”, “Payments for new loans” and “Payments for loans” are more often involved in positive paths. Figure 5-119 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

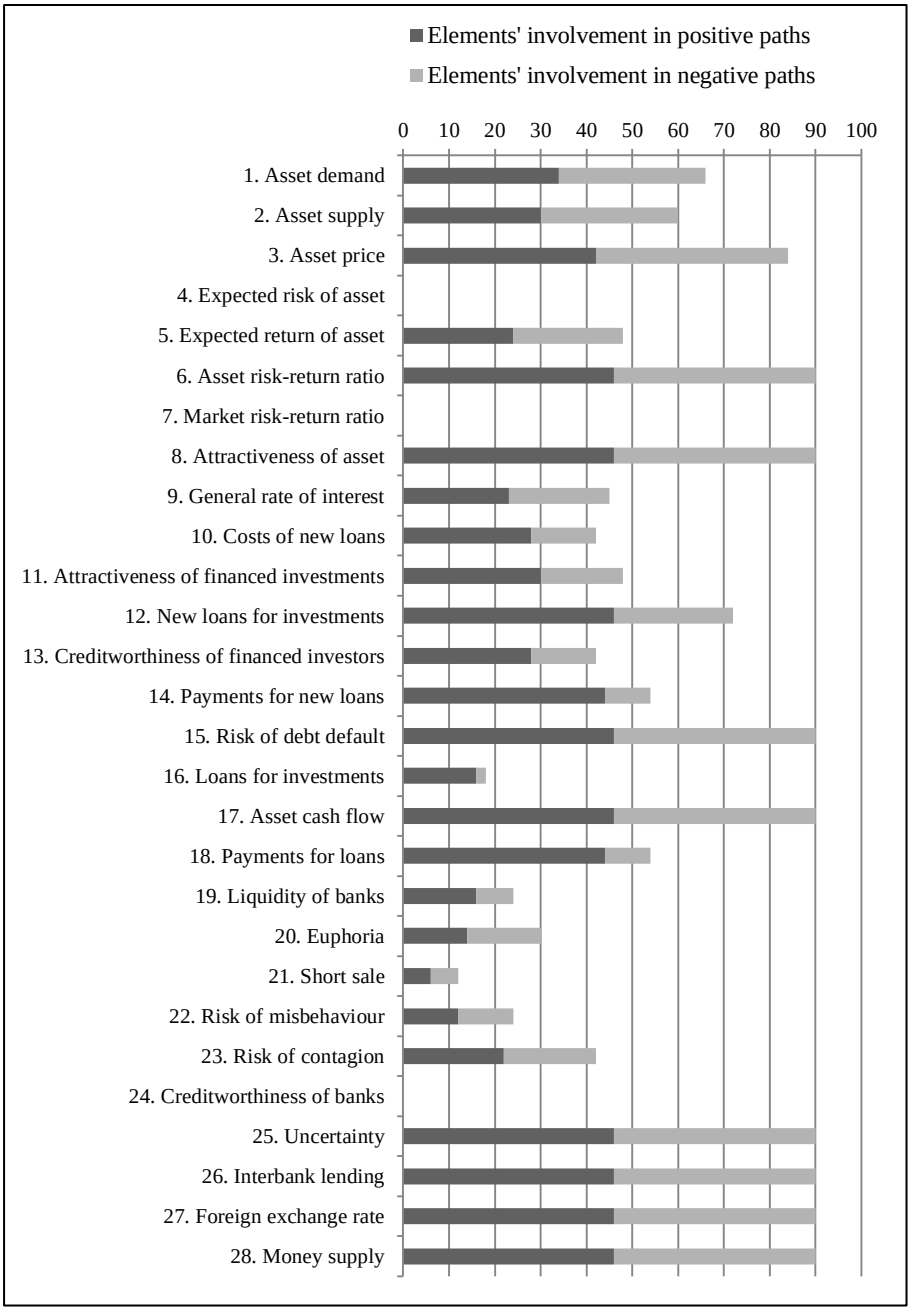


Figure 5-119: Involvement of elements in paths from Element 6 to Element 27 (from Element "Asset risk-return ratio" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Asset risk-return ratio" slightly increases the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of negative paths are shorter than those of positive paths, which intensify the effects of negative paths. Therefore, it is assumed that the initial impulse of increasing the Element "Asset risk-return ratio" neither

increases nor decreases the Element “Asset price”.

The initial impulse of decreasing the Element “Asset risk-return ratio” slightly decreases the Element “Foreign exchange rate” according to the number of positive and negative paths. However, the lengths of negative paths are shorter than those of positive paths, which intensify the effects of negative paths. Therefore, it is assumed that the initial impulse of decreasing the Element “Asset risk-return ratio” neither increases nor decreases the Element “Asset price”.

Paths from Element 7 (Market risk-return ratio) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element “Market risk-return ratio” leads to an increase of the Element “Asset price” in 2 cases. In 4 cases the initial impulse of an increase of the Element “Market risk-return ratio” leads to a decrease of the Element “Asset price”.
The initial impulse of a decrease of the Element “Market risk-return ratio” leads to a decrease of the Element “Asset price” in 2 cases. In 4 cases the initial impulse of a decrease of the Element “Market risk-return ratio” leads to an increase of the Element “Asset price”.
33.3% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 15.5 for positive paths and 6.5 for negative paths. The median is 15.5 for positive paths and 5.0 for negative paths. For a detailed list of numbers please refer to Appendix 5.

The Element “Attractiveness of asset” is directly related and, therefore, more often involved in paths from Element 7 to Element 3. Elements are equally involved in positive and negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Market risk-return ratio" decreases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of increasing the Element "Market risk-return ratio" decreases the Element "Asset price".

The initial impulse of decreasing the Element "Market risk-return ratio" increases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Market risk-return ratio" increases the Element "Asset price".

Paths from Element 7 (Market risk-return ratio) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Market risk-return ratio" leads to an increase of the Element "Liquidity of banks" in 147 cases. In 136 cases the initial impulse of an increase of the Element "Market risk-return ratio" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Market risk-return ratio" leads to a decrease of the Element "Liquidity of banks" in 147 cases. In 136 cases the initial impulse of a decrease of the Element "Market risk-return ratio" leads to an increase of the Element "Liquidity of banks".

3.9% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 15.4 for positive paths and 15.0 for negative paths. The median is 15.0 for

positive paths and 14.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-120 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

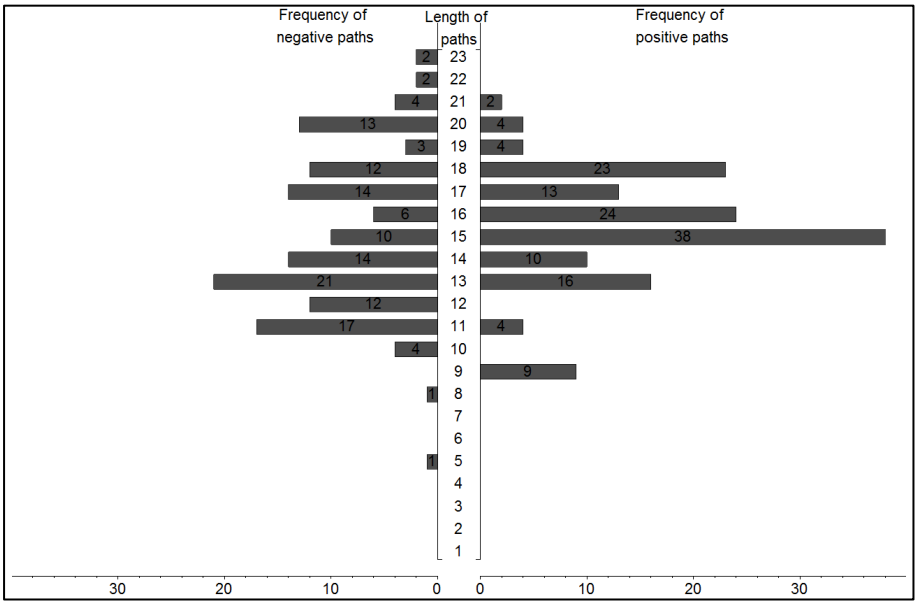


Figure 5-120: Length of paths from Element 7 to Element 19 (from Element "Market risk-return ratio" to Element "Liquidity of banks")

The Element "Attractiveness of asset" is directly related and, therefore, more often involved in paths from Element 7 to Element 19. Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest ", "Costs of new loans" and "Money supply" are more often involved in positive paths. Figure 5-121 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

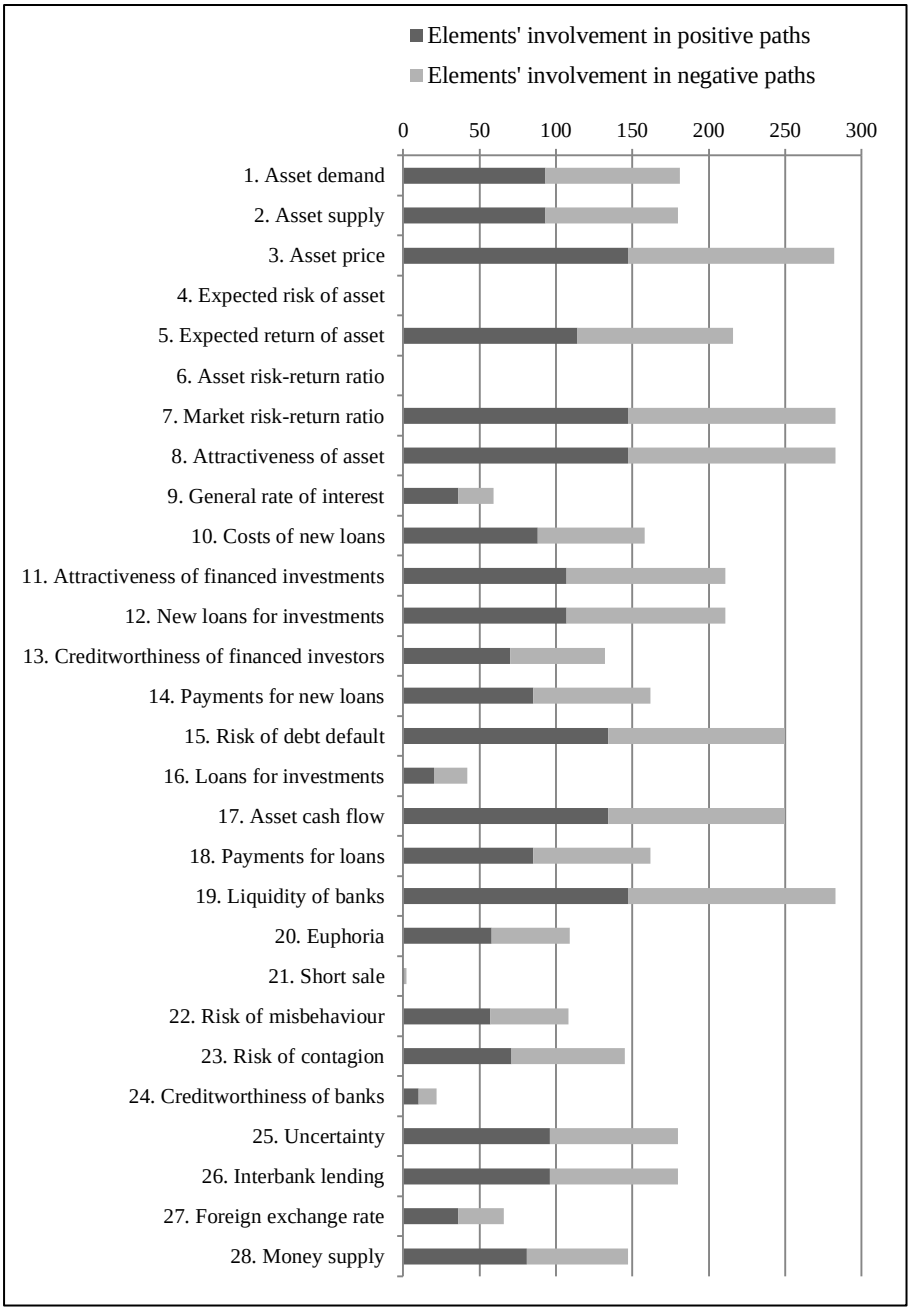


Figure 5-121: Involvement of elements in paths from Element 7 to Element 19 (from Element "Market risk-return ratio" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Market risk-return ratio" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Market risk-return ratio" slightly decreases the Element "Liquidity of banks".

Paths from Element 7 (Market risk-return ratio) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Market risk-return ratio" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 46 cases the initial impulse of an increase of the Element "Market risk-return ratio" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Market risk-return ratio" leads to a decrease of the Element "Foreign exchange rate" in 44 cases. In 46 cases the initial impulse of a decrease of the Element "Market risk-return ratio" leads to an increase of the Element "Foreign exchange rate".

2.2% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 15.0 for positive paths and 18.0 for negative paths. The median is 15.0 for positive paths and 18.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-122 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

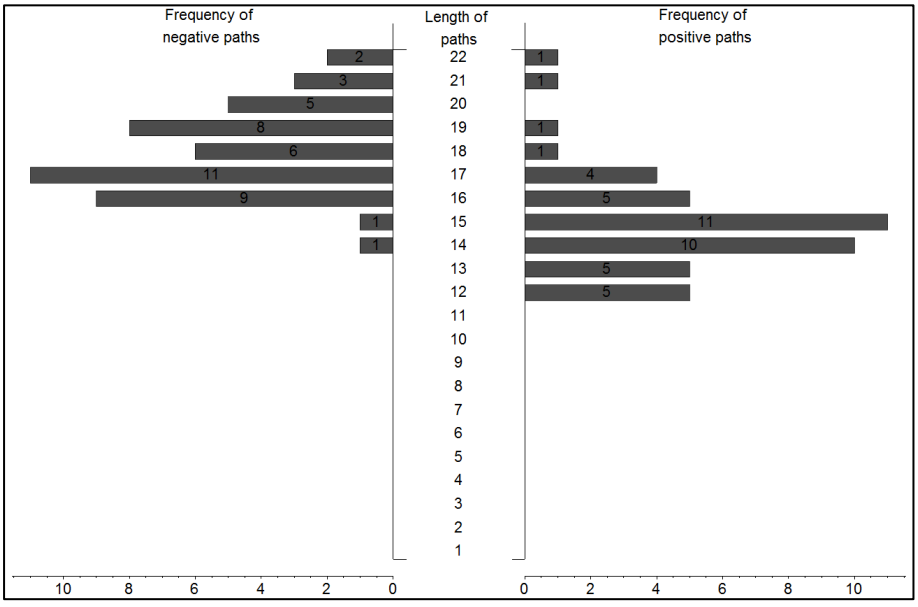


Figure 5-122: Length of paths from Element 7 to Element 27 (from Element "Market risk-return ratio" to Element "Foreign exchange rate")

The Element “Attractiveness of asset” is directly related and, therefore, more often involved in paths from Element 7 to Element 27. Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Costs of new loans“, “Attractiveness of financed investments”, “New loans for investments”, “Creditworthiness of financed investors”, “Payments for new loans” and “Payments for loans” are more often involved in negative paths. Figure 5-123 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

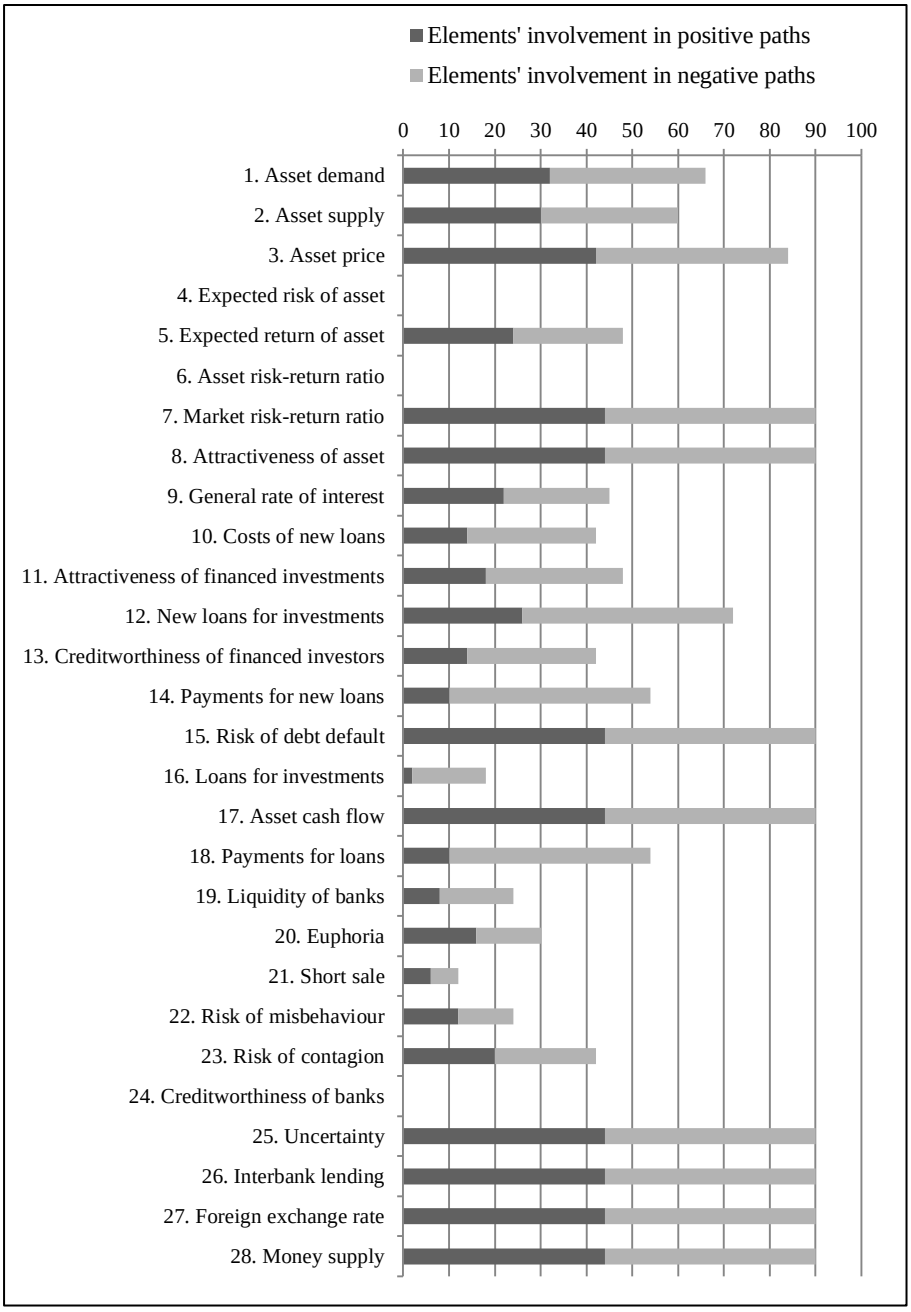


Figure 5-123: Involvement of elements in paths from Element 7 to Element 27 (from Element "Market risk-return ratio" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Market risk-return ratio" slightly decreases the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of increasing the Element "Market risk-return

ratio" neither increases nor decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Market risk-return ratio" slightly increases the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of positive paths are shorter than those of negative paths, which intensify the effects of positive paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Market risk-return ratio" neither increases nor decreases the Element "Foreign exchange rate".

Paths from Element 8 (Attractiveness of asset) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Attractiveness of asset" leads to an increase of the Element "Asset price" in 4 cases. In 2 cases the initial impulse of an increase of the Element "Attractiveness of asset" leads to a decrease of the Element "Asset price".
The initial impulse of a decrease of the Element "Attractiveness of asset" leads to a decrease of the Element "Asset price" in 4 cases. In 2 cases the initial impulse of a decrease of the Element "Attractiveness of asset" leads to an increase of the Element "Asset price".
33.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

Negative paths are longer than positive paths. The mean is 5.5 for positive paths and 14.5 for negative paths. The median is 4.0 for positive paths and 14.5 for negative paths. For a detailed list of numbers please refer to Appendix 5.

Next to other elements, the Element "Asset demand" is directly related and, therefore, more often involved in paths from Element 8 to Element 3. Elements are equally involved in positive and negative paths. For a detailed list of numbers please refer to Appendix 6.

Interpretation: The initial impulse of increasing the Element "Attractiveness of asset" increases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of positive paths is shorter than the length of negative paths, which intensives the effects of positive paths. Therefore, it is assumed that the initial impulse of increasing the Element "Attractiveness of asset" increases the Element "Asset price".

The initial impulse of decreasing the Element "Attractiveness of asset" decreases the Element "Asset price" according to the number of positive and negative paths. In addition, the length of positive paths is shorter than the length of negative paths, which intensives the effects of positive paths. Therefore, it is assumed that The initial impulse of decreasing the Element "Attractiveness of asset" decreases the Element "Asset price".

Paths from Element 8 (Attractiveness of asset) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Attractiveness of asset" leads to an increase of the Element "Liquidity of banks" in 136 cases. In 147 cases the initial impulse of an increase of the Element "Attractiveness of asset" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Attractiveness of asset" leads to a decrease of the Element "Liquidity of banks" in 136 cases. In 147 cases the initial impulse of a decrease of the Element "Attractiveness of asset" leads to an increase of the Element "Liquidity of banks".

3.9% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter positive paths are equalised by longer positive paths. The mean is 14.0 for

positive paths and 14.4 for negative paths. The median is 13.0 for positive paths and 14.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-124 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

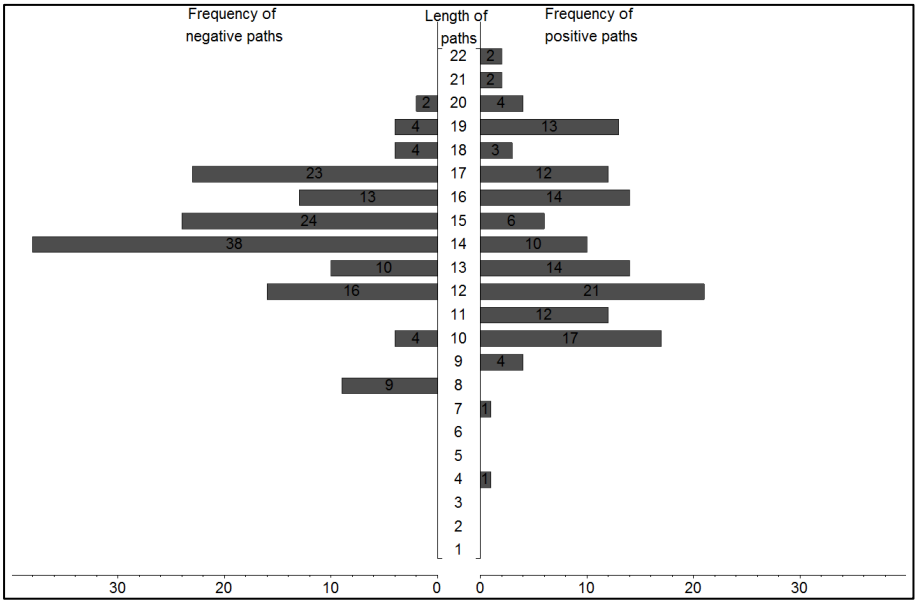


Figure 5-124: Length of paths from Element 8 to Element 19 (from Element "Attractiveness of asset" to Element "Liquidity of banks")

Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles in paths from Element 8 to Element 19. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest", "Costs of new loans" and "Money supply" are more often involved in negative paths. Figure 5-125 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

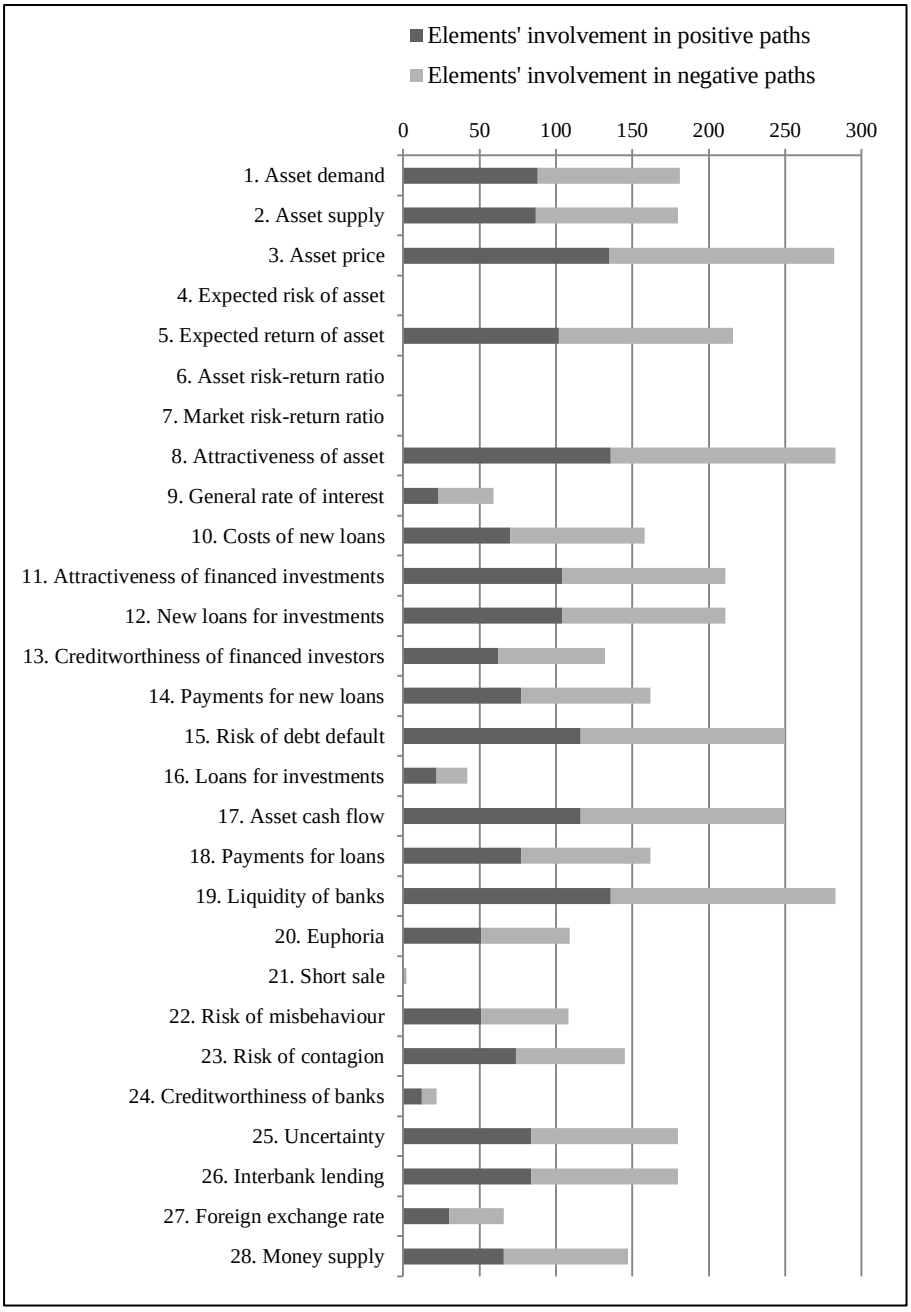


Figure 5-125: Involvement of elements in paths from Element 8 to Element 19 (from Element "Attractiveness of asset" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Attractiveness of asset" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Attractiveness of asset" slightly increases the Element "Liquidity of banks".

Paths from Element 8 (Attractiveness of asset) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Attractiveness of asset" leads to an increase of the Element "Foreign exchange rate" in 46 cases. In 44 cases the initial impulse of an increase of the Element "Attractiveness of asset" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Attractiveness of asset" leads to a decrease of the Element "Foreign exchange rate" in 46 cases. In 44 cases the initial impulse of a decrease of the Element "Attractiveness of asset" leads to an increase of the Element "Foreign exchange rate".

2.2% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 17.0 for positive paths and 14.0 for negative paths. The median is 17.0 for positive paths and 14.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-126 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

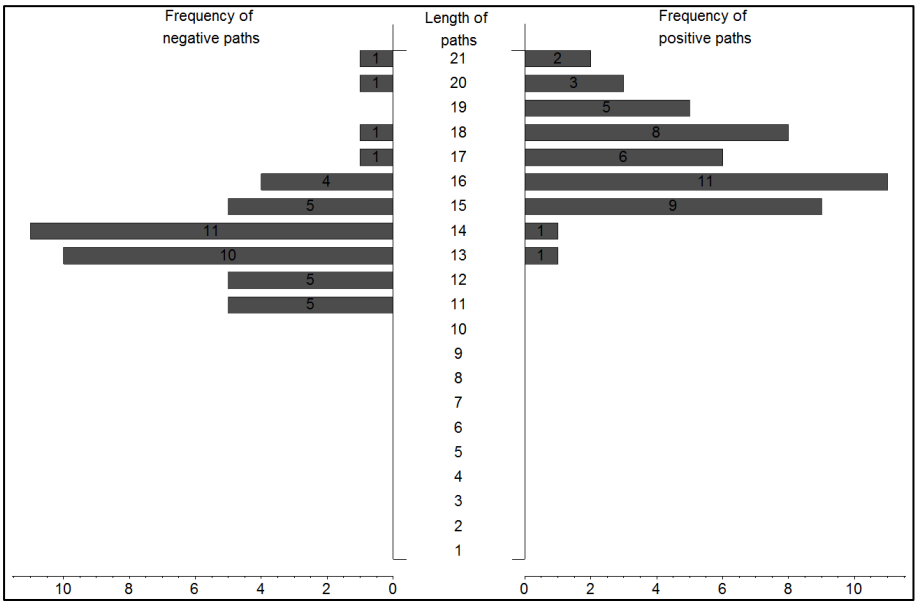


Figure 5-126: Length of paths from Element 8 to Element 27 (from Element "Attractiveness of asset" to Element "Foreign exchange rate")

Indirectly, the Elements “Asset price”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, Interbank lending” and “Money supply” play significant roles in paths from Element 8 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Costs of new loans“, “Attractiveness of financed investments“, “New loans for investments”, “Creditworthiness of financed investors”, “Payments for new loans” and “Payments for loans” are more often involved in positive paths. Figure 5-127 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

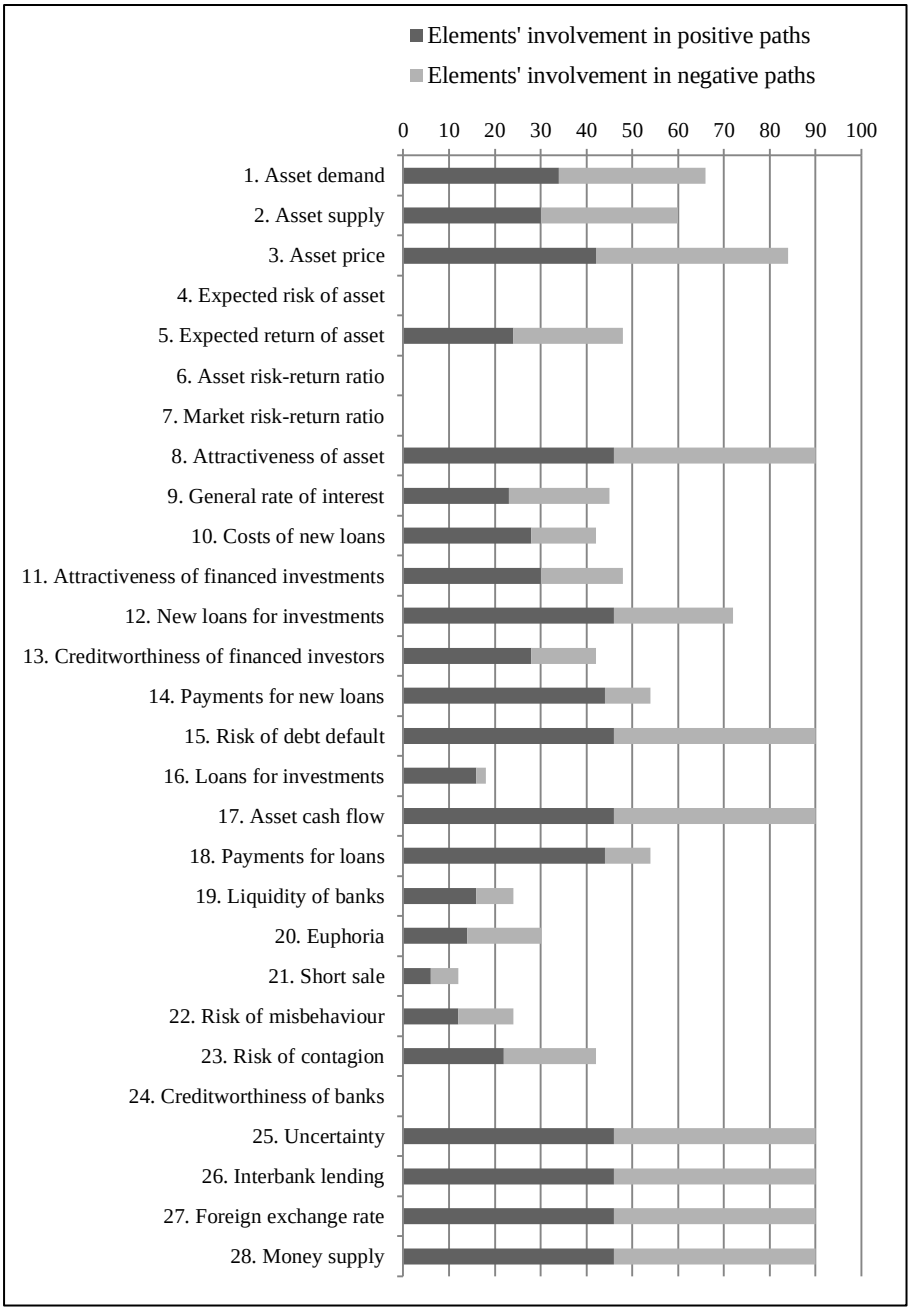


Figure 5-127: Involvement of elements in paths from Element 8 to Element 27 (from Element "Attractiveness of asset" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Attractiveness of asset" slightly increases the Element "Foreign exchange rate" according to the number of positive and negative paths. However, the lengths of negative paths are shorter than those of positive paths, which intensify the effects of negative paths. Therefore, it is assumed that the initial impulse of increasing the Element "Attractiveness of asset" neither

increases nor decreases the Element “Foreign exchange rate”.

The initial impulse of decreasing the Element “Attractiveness of asset” slightly decreases the Element “Foreign exchange rate” according to the number of positive and negative paths. However, the lengths of negative paths are shorter than those of positive paths, which intensify the effects of negative paths. Therefore, it is assumed that the initial impulse of decreasing the Element “Attractiveness of asset” neither increases nor decreases the Element “Foreign exchange rate”.

Paths from Element 10 (Costs of new loans) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element “Costs of new loans” leads to an increase of the Element “Asset price” in 64 cases. In 66 cases the initial impulse of an increase of the Element “Costs of new loans” leads to a decrease of the Element “Asset price”.

The initial impulse of a decrease of the Element “Costs of new loans” leads to a decrease of the Element “Asset price” in 64 cases. In 66 cases the initial impulse of a decrease of the Element “Costs of new loans” leads to an increase of the Element “Asset price”.

1.5% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 13.2 for positive paths and 13.0 for negative paths. The median is 14.0 for positive paths and 13.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-128 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

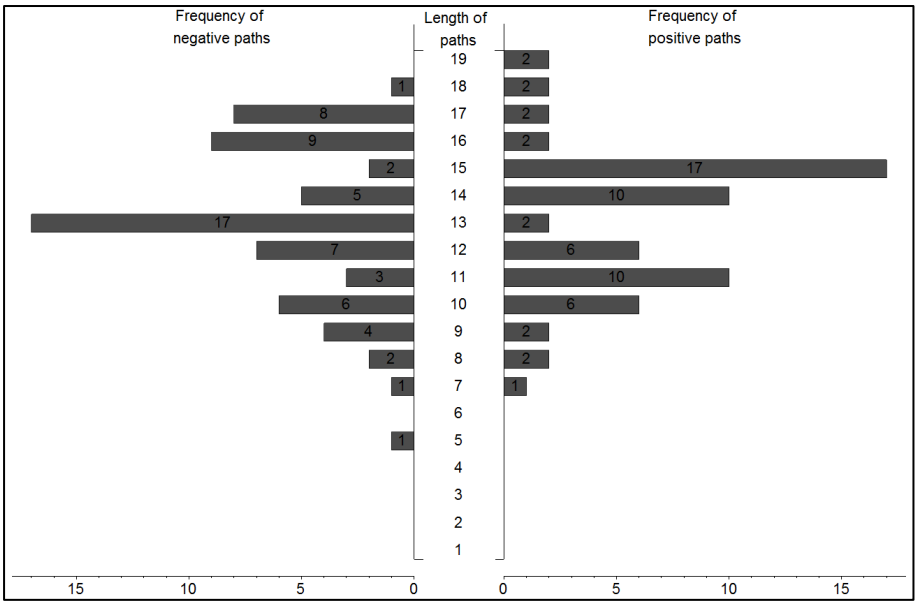


Figure 5-128: Length of paths from Element 10 to Element 3 (from Element "Costs of new loans" to Element "Asset price")

Indirectly, the Elements "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles in paths from Element 10 to Element 3. Elements are equally involved in positive and negative paths. Figure 5-129 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

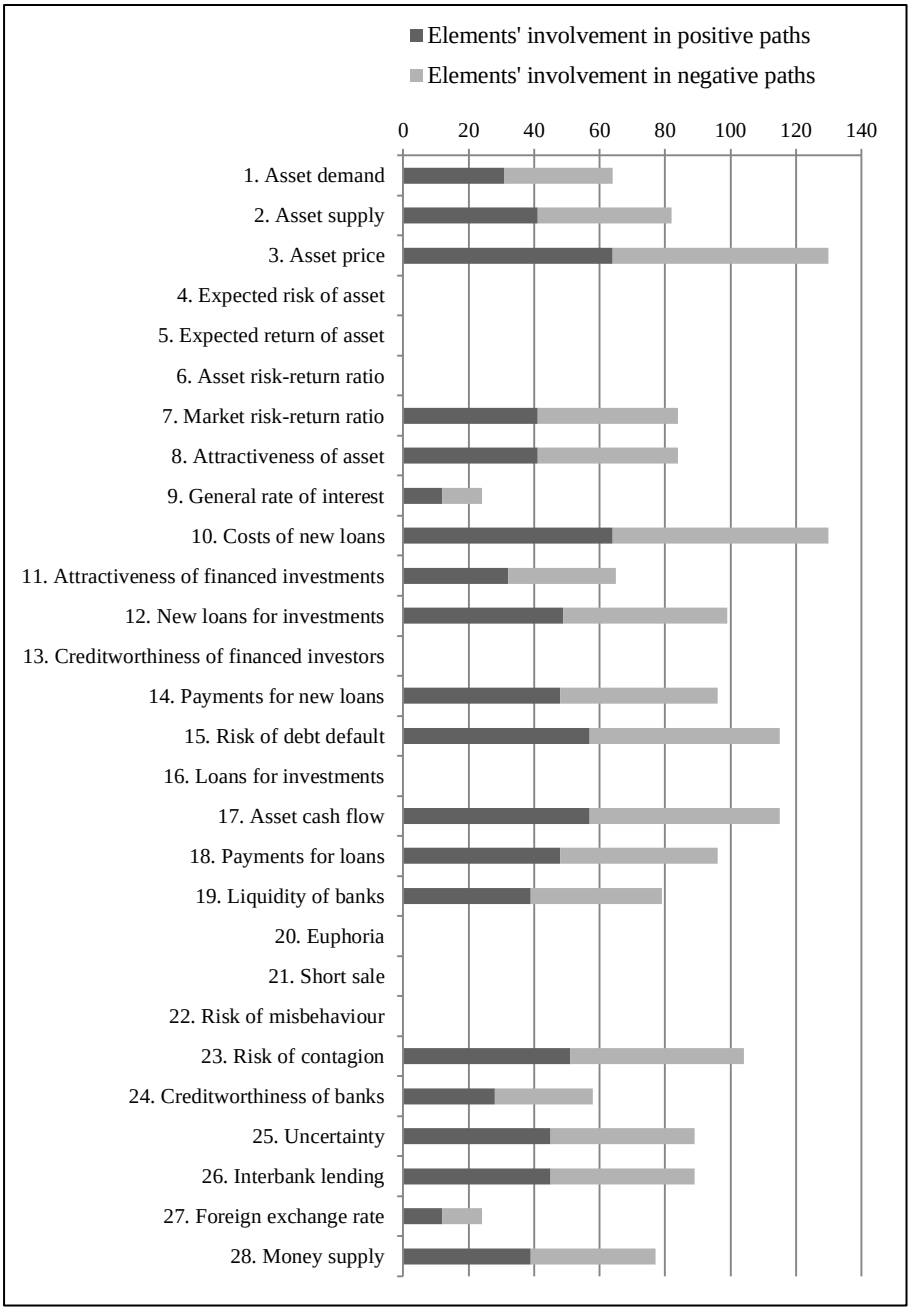


Figure 5-129: Involvement of elements in paths from Element 10 to Element 3 (from Element "Costs of new loans" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Costs of new loans" slightly decreases the Element "Asset price".

The initial impulse of decreasing the Element "Costs of new loans" slightly increases the Element "Asset price".

Paths from Element 10 (Costs of new loans) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Costs of new loans" leads to an increase of the Element "Liquidity of banks" in 60 cases. In 66 cases the initial impulse of an increase of the Element "Costs of new loans" leads to a decrease of the Element "Liquidity of banks".
The initial impulse of a decrease of the Element "Costs of new loans" leads to a decrease of the Element "Liquidity of banks" in 60 cases. In 66 cases the initial impulse of a decrease of the Element "Costs of new loans" leads to an increase of the Element "Liquidity of banks".
4.8% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.9 for positive paths and 14.4 for negative paths. The median is 16.0 for positive paths and 15.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-130 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

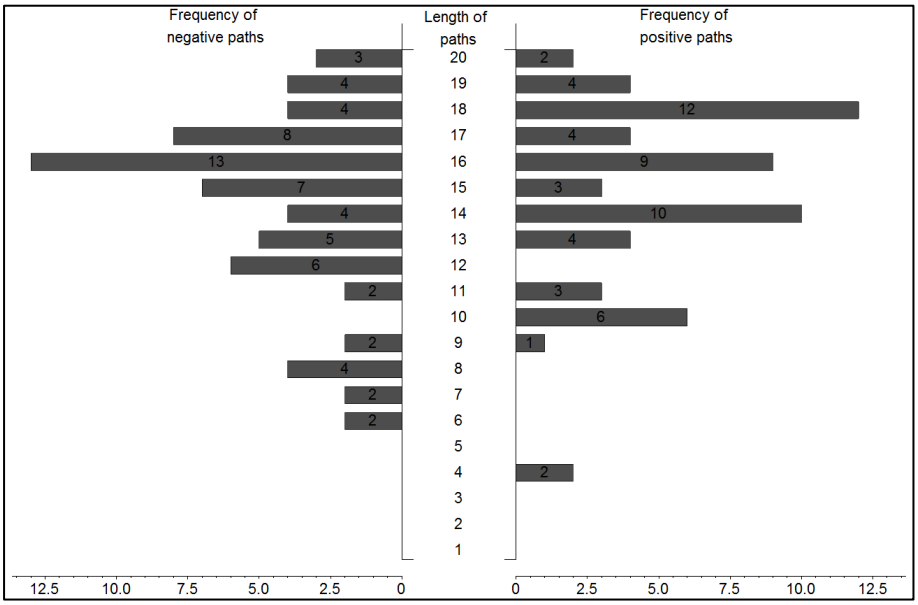


Figure 5-130: Length of paths from Element 10 to Element 19 (from Element "Costs of new loans" to Element "Liquidity of banks")

Next to other elements, the Element "Attractiveness of financed investment" is directly related and, therefore, more often involved in

paths from Element 10 to Element 19. Indirectly, the Elements "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-131 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

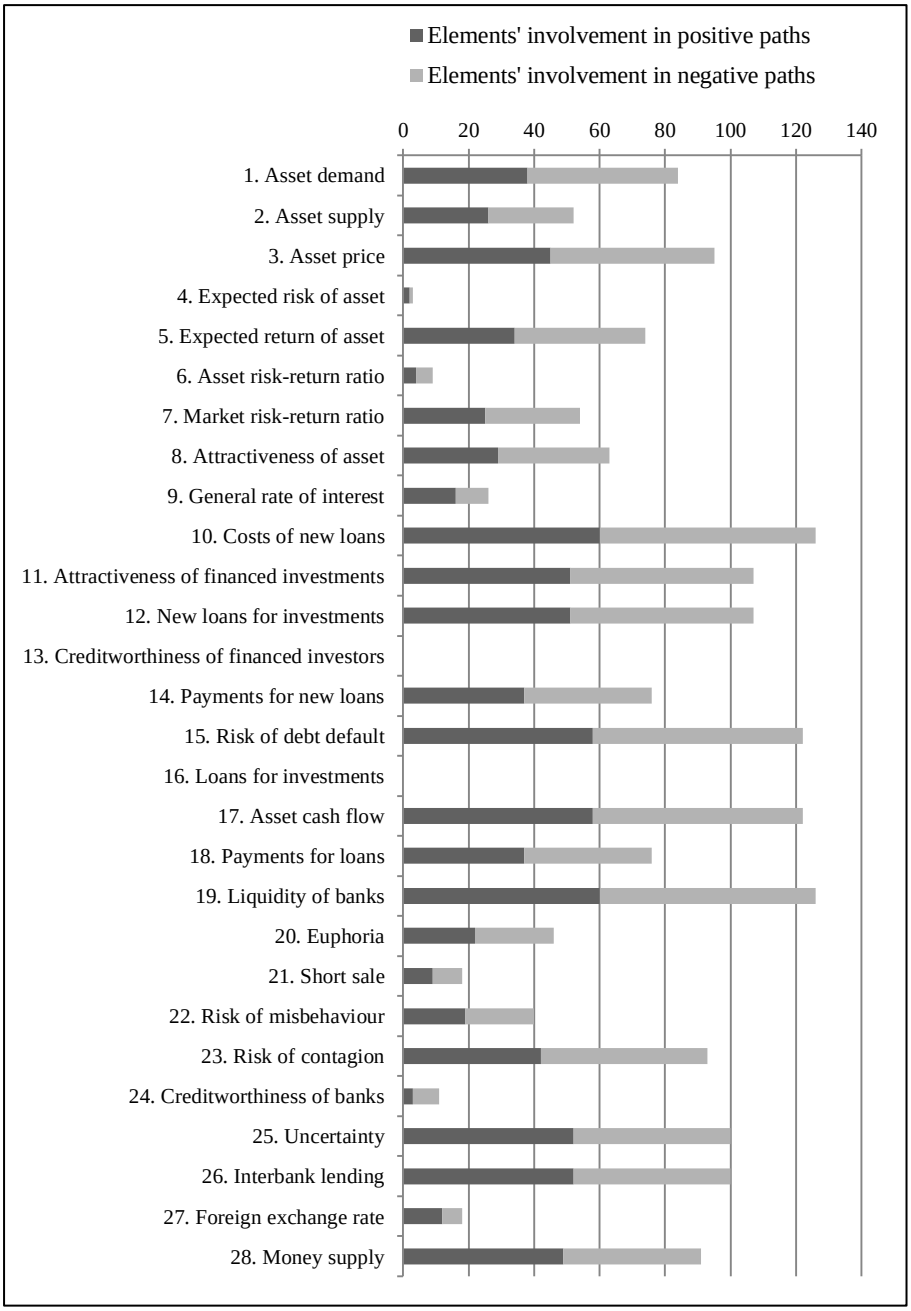


Figure 5-131: Involvement of elements in paths from Element 10 to Element 19 (from Element "Costs of new loans" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Costs of new loans" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Costs of new loans" slightly increases the Element "Liquidity of banks".

Paths from Element 10 (Costs of new loans) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Costs of new loans" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 36 cases the initial impulse of an increase of the Element "Costs of new loans" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Costs of new loans" leads to a decrease of the Element "Foreign exchange rate" in 44 cases. In 36 cases the initial impulse of a decrease of the Element "Costs of new loans" leads to an increase of the Element "Foreign exchange rate".

10.0% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 17.4 for positive paths and 17.2 for negative paths. The median is 18.5 for positive paths and 17.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-132 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

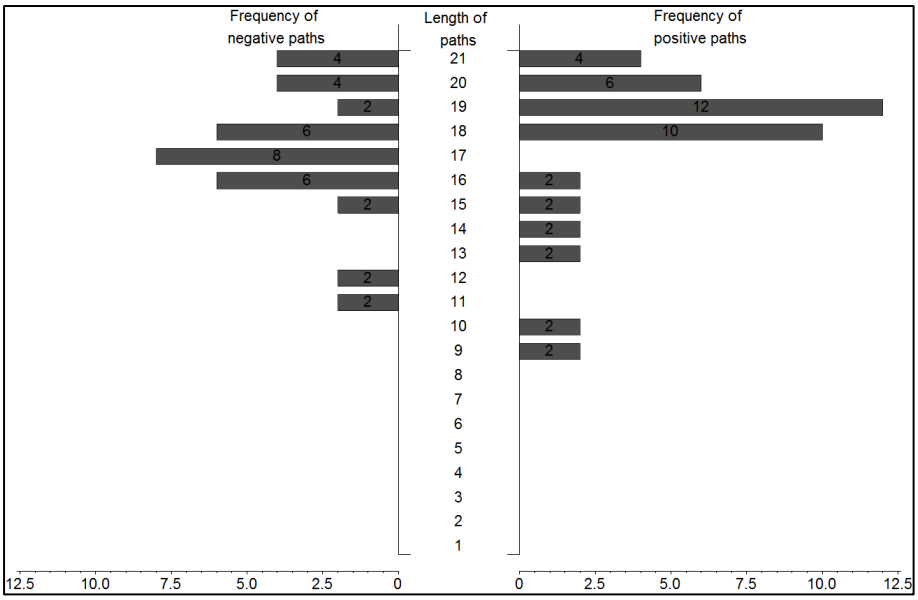


Figure 5-132: Length of paths from Element 10 to Element 27 (from Element "Costs of new loans" to Element "Foreign exchange rate")

Indirectly, the Elements "Asset price", "Expected return of asset", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles in paths from Element 10 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Asset demand", "Asset price", "Expected return of asset", "Market risk-return ratio", "Attractiveness of asset", "Attractiveness of financed investments", "Euphoria", "Risk of misbehaviour", "Risk of contagion" and "Creditworthiness of banks" are more often involved in positive paths. Figure 5-133 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

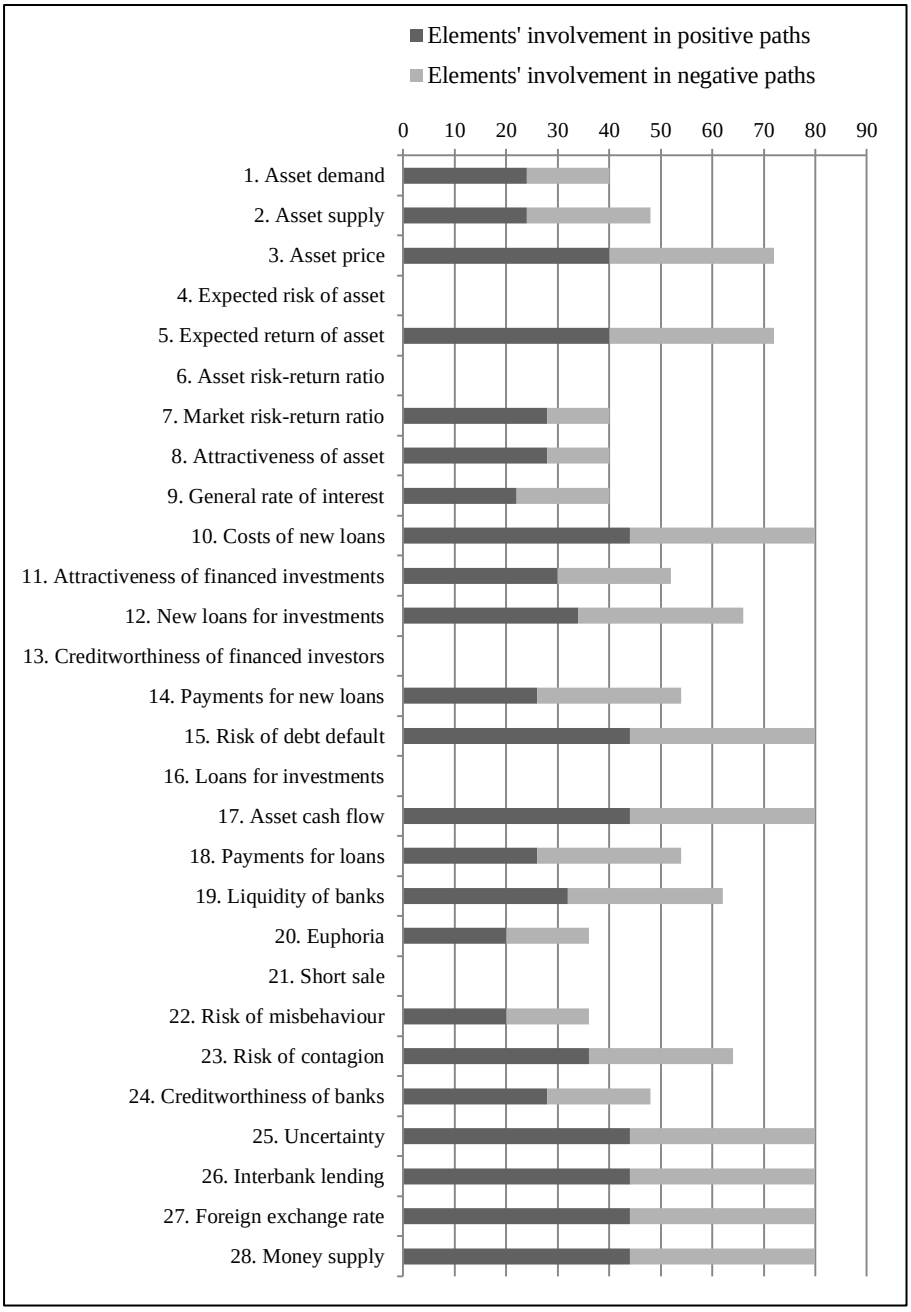


Figure 5-133: Involvement of elements in paths from Element 10 to Element 27 (from Element "Costs of new loans" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Costs of new loans" increases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Costs of new loans" decreases the Element "Foreign exchange rate".

Paths from Element 11 (Attractiveness of financed investments) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Attractiveness of financed investments" leads to an increase of the Element "Asset price" in 52 cases. In 50 cases the initial impulse of an increase of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Asset price" in 52 cases. In 50 cases the initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to an increase of the Element "Asset price".

2.0% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 13.7 for positive paths and 13.9 for negative paths. The median is 15.0 for positive paths and 14.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-134 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

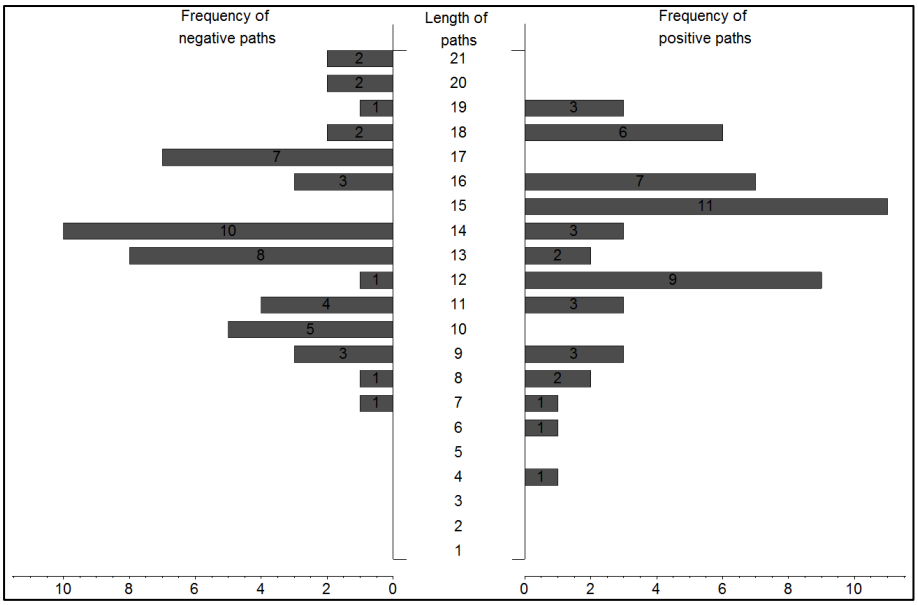


Figure 5-134: Length of paths from Element 11 to Element 3 (from Element "Attractiveness of financed investments" to Element "Asset price")

The Element "New loans for investments" is directly related and, therefore, more often involved in paths from Element 11 to Element 3. Indirectly, the Elements "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-135 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

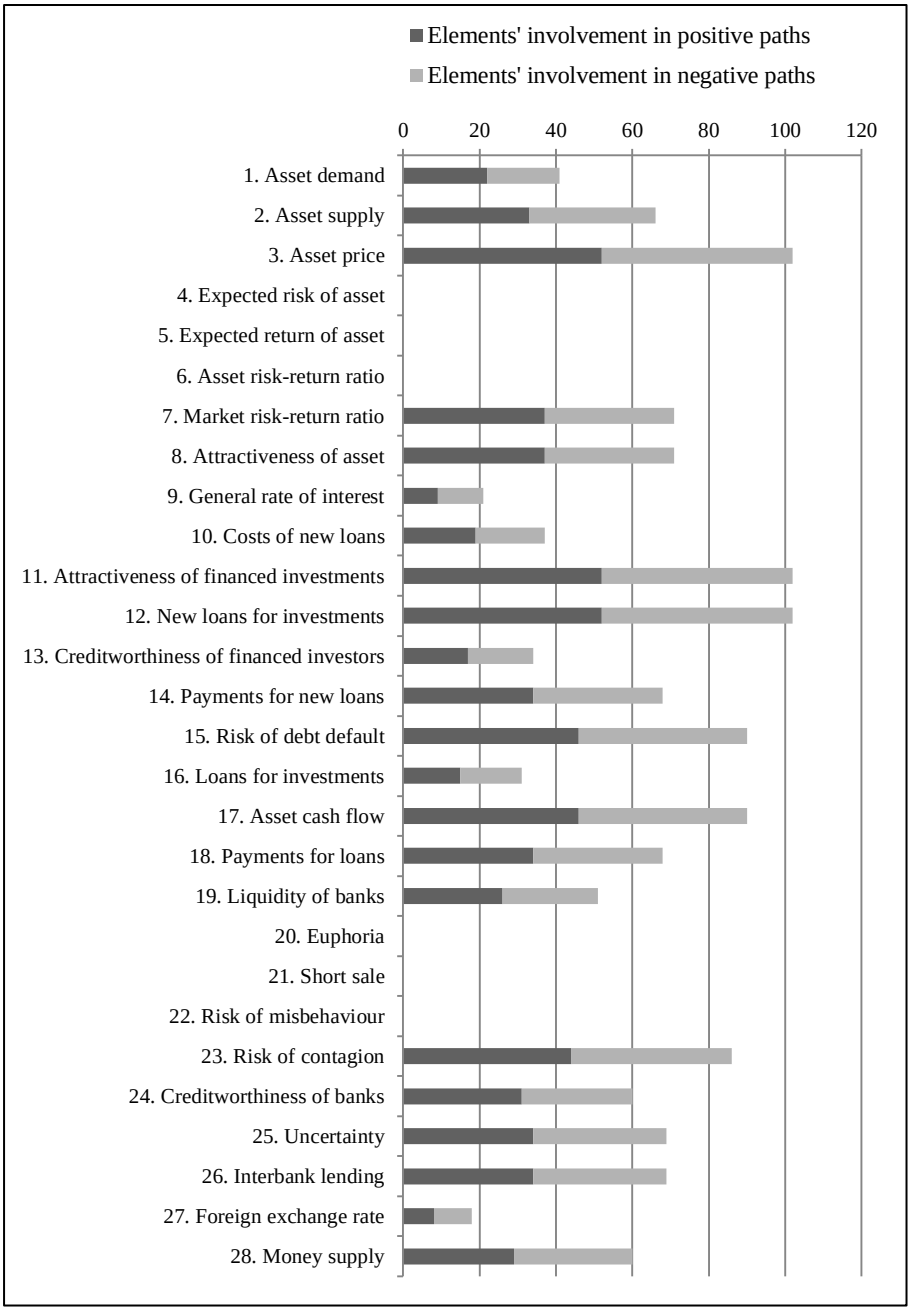


Figure 5-135: Involvement of elements in paths from Element 11 to Element 3 (from Element "Attractiveness of financed investments" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Attractiveness of financed investments" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Attractiveness of financed investments" slightly decreases the Element "Asset price".

Paths from Element 11 (Attractiveness of financed investments) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Attractiveness of financed investments" leads to an increase of the Element "Liquidity of banks" in 66 cases. In 70 cases the initial impulse of an increase of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Liquidity of banks" in 66 cases. In 70 cases the initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to an increase of the Element "Liquidity of banks".

2.9% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.1 for positive paths and 14.5 for negative paths. The median is 14.0 for positive paths and 15.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-136 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

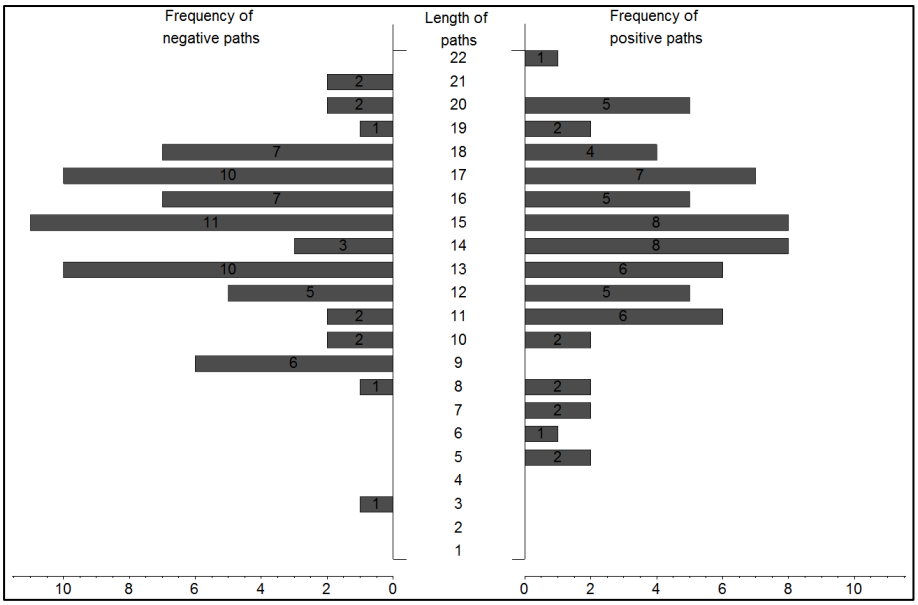


Figure 5-136: Length of paths from Element 11 to Element 19 (from Element "Attractiveness of financed investments" to Element "Liquidity of banks")

The Element "New loans for investments" is directly related and, therefore, more often involved in paths from Element 11 to Element 19. Indirectly, the Elements "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest", "Costs of new loans" and "Money supply" are more often involved in negative paths. The Elements "Market risk-return ratio" and "Attractiveness of asset" are more often involved in positive paths. Figure 5-137 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

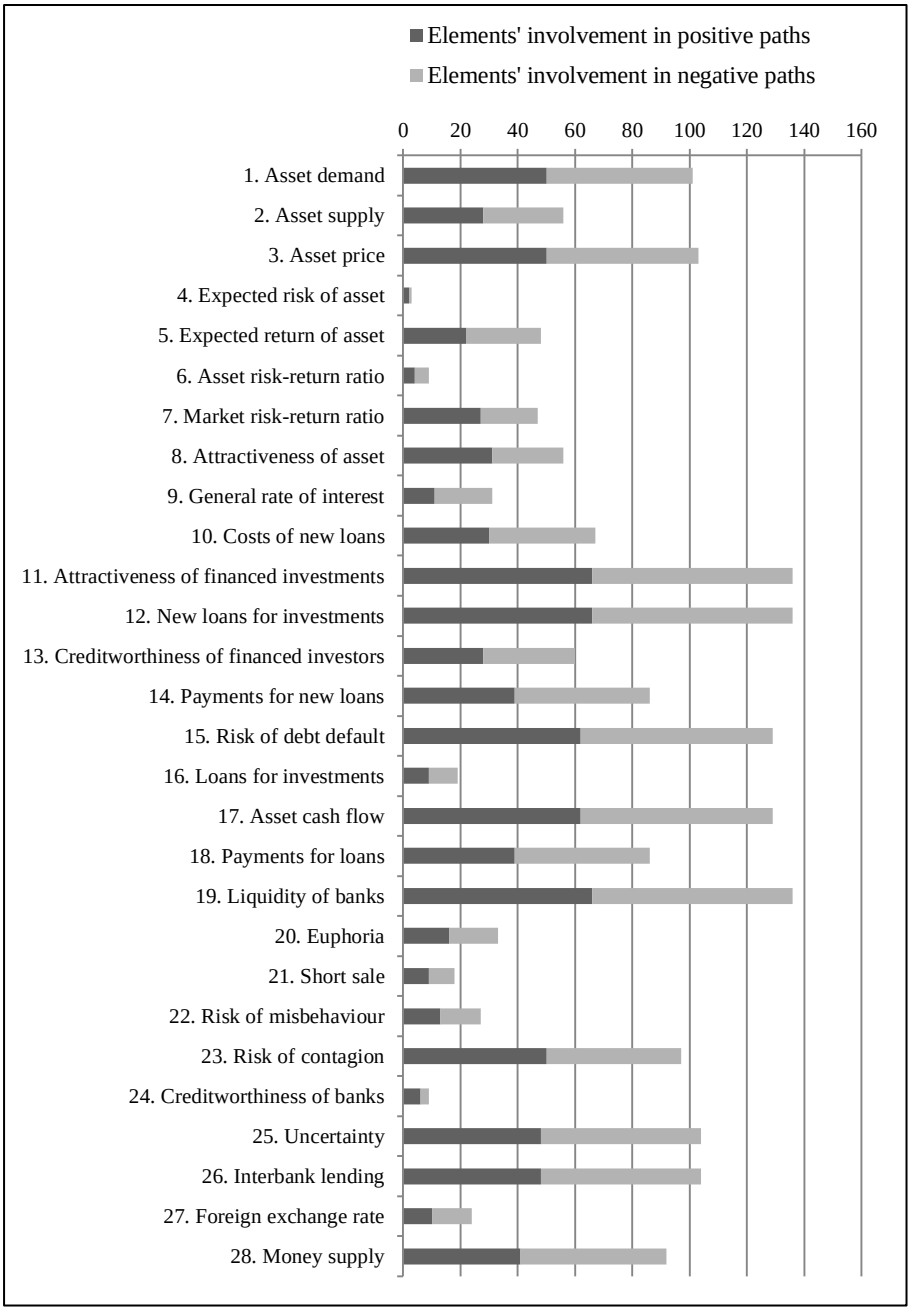


Figure 5-137: Involvement of elements in paths from Element 11 to Element 19 (from Element "Attractiveness of financed investments" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Attractiveness of financed investments" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Attractiveness of

financed investments" slightly increases the Element "Liquidity of banks".

Paths from Element 11 (Attractiveness of financed investments) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Attractiveness of financed investments" leads to an increase of the Element "Foreign exchange rate" in 32 cases. In 34 cases the initial impulse of an increase of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to a decrease of the Element "Foreign exchange rate" in 32 cases. In 34 cases the initial impulse of a decrease of the Element "Attractiveness of financed investments" leads to an increase of the Element "Foreign exchange rate".

3.0% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 18.3 for positive paths and 16.4 for negative paths. The median is 19.0 for positive paths and 17.0 for negative paths. The spreads of the lengths of positive paths and negative paths are identical. Figure 5-138 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

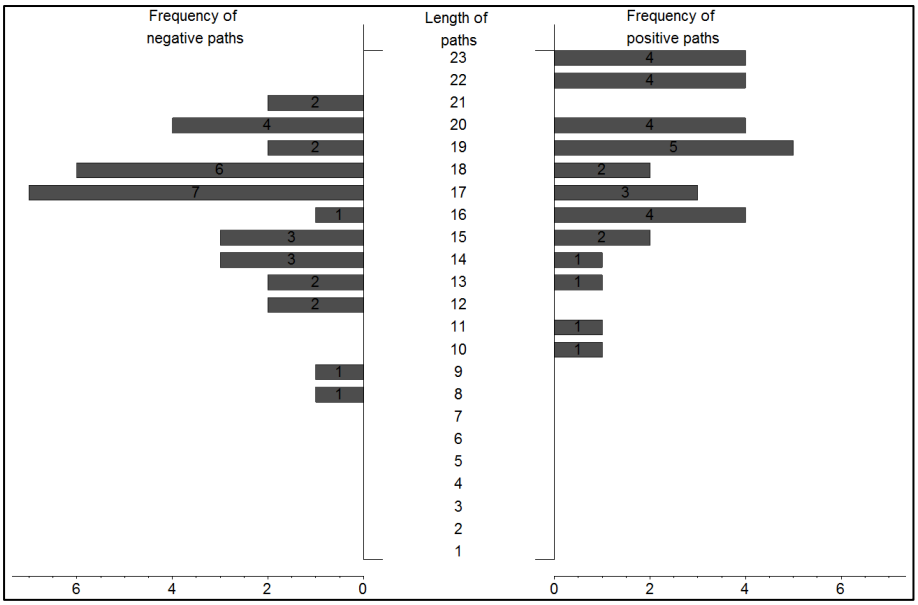


Figure 5-138: Length of paths from Element 11 to Element 27 (from Element "Attractiveness of financed investments" to Element "Foreign exchange rate")

The Element "New loans for investments" is directly related and, therefore, more often involved in paths from Element 11 to Element 27. Indirectly, the Elements "Asset price", "Risk of debt default", "Asset cash flow", "Risk of contagion", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Element "Asset demand" is more often involved in negative paths. The Elements "Market risk-return ratio", "Attractiveness of asset", "Payments for new loans" and "Payments for loans" are more often involved in positive paths. Figure 5-139 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

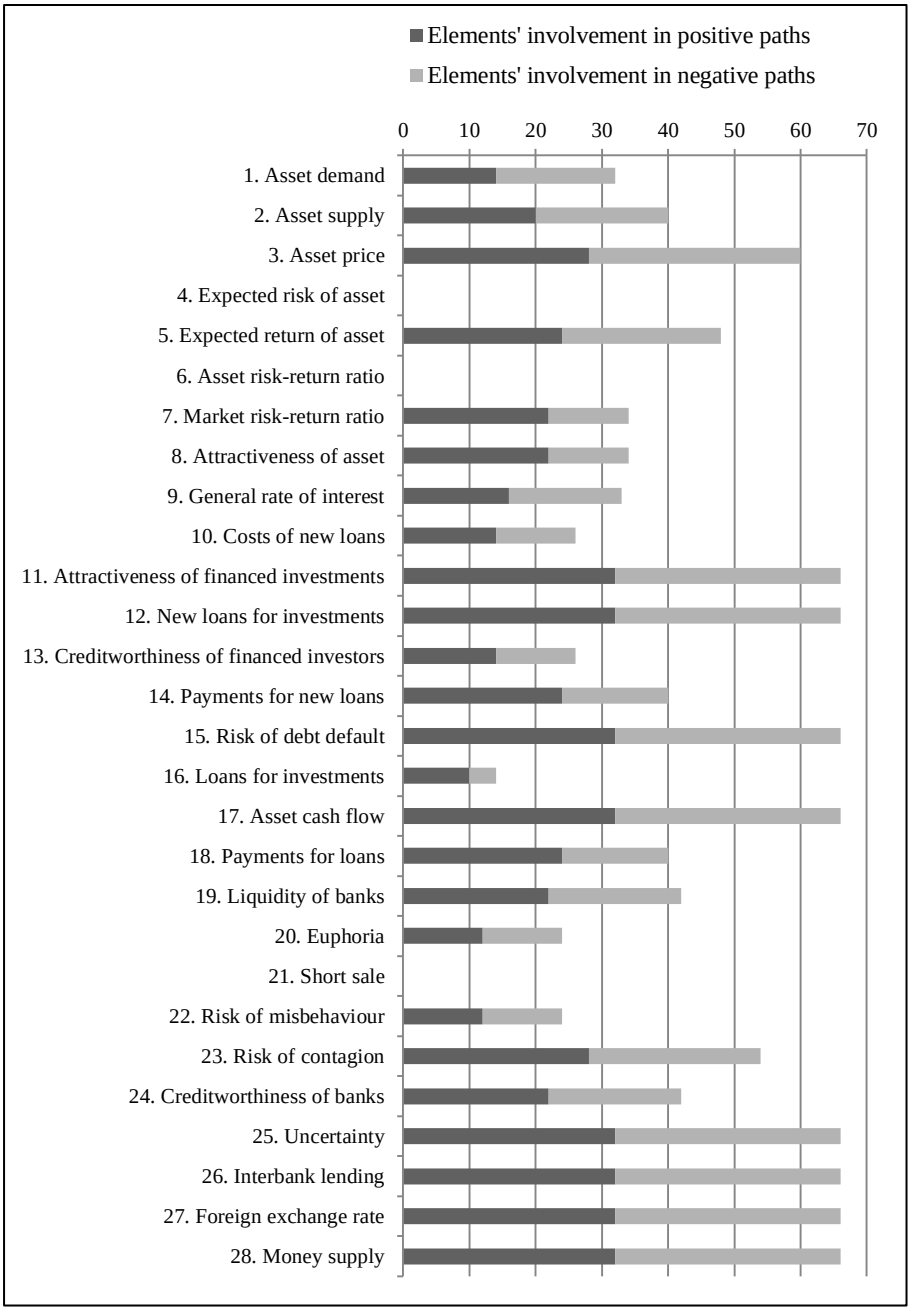


Figure 5-139: Involvement of elements in paths from Element 11 to Element 27 (from Element "Attractiveness of financed investments" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Attractiveness of financed investments" slightly decreases the Element "Foreign exchange rate" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths.

Therefore, it is assumed that the initial impulse of increasing the Element "Attractiveness of financed investments" decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Attractiveness of financed investments" slightly increases the Element "Foreign exchange rate" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of decreasing the Element "Attractiveness of financed investments" increases the Element "Foreign exchange rate".

Paths from Element 12 (New loans for investments) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "New loans for investments" leads to an increase of the Element "Asset price" in 52 cases. In 50 cases the initial impulse of an increase of the Element "New loans for investments" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "New loans for investments" leads to a decrease of the Element "Asset price" in 52 cases. In 50 cases the initial impulse of a decrease of the Element "New loans for investments" leads to an increase of the Element "Asset price".

2.0% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 12.7 for positive paths and 12.9 for negative paths. The median is 14.0 for positive paths and 13.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-140 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

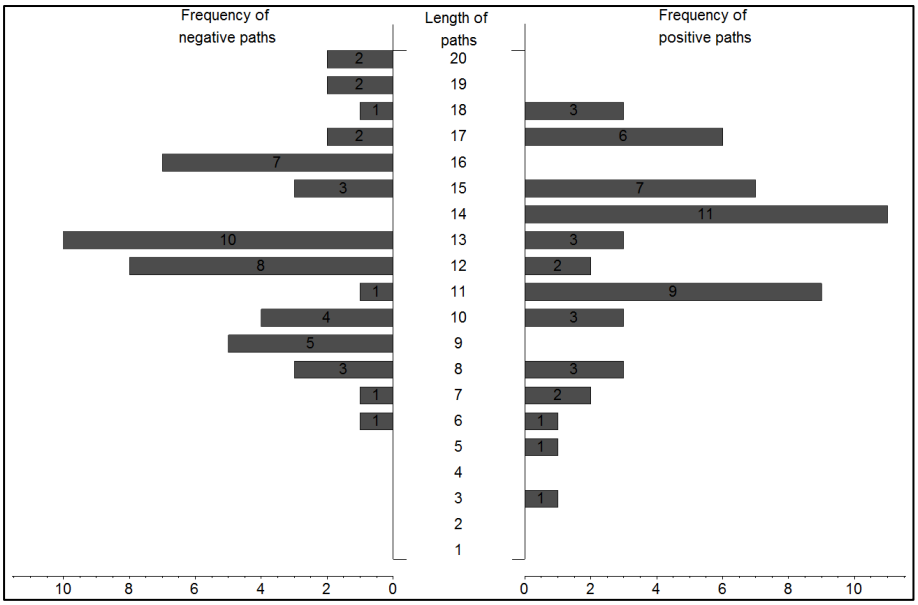


Figure 5-140: Length of paths from Element 12 to Element 3 (from Element "New loans for investments" to Element "Asset price")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 12 to Element 3. Indirectly, the Elements "Risk of debt default" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-141 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

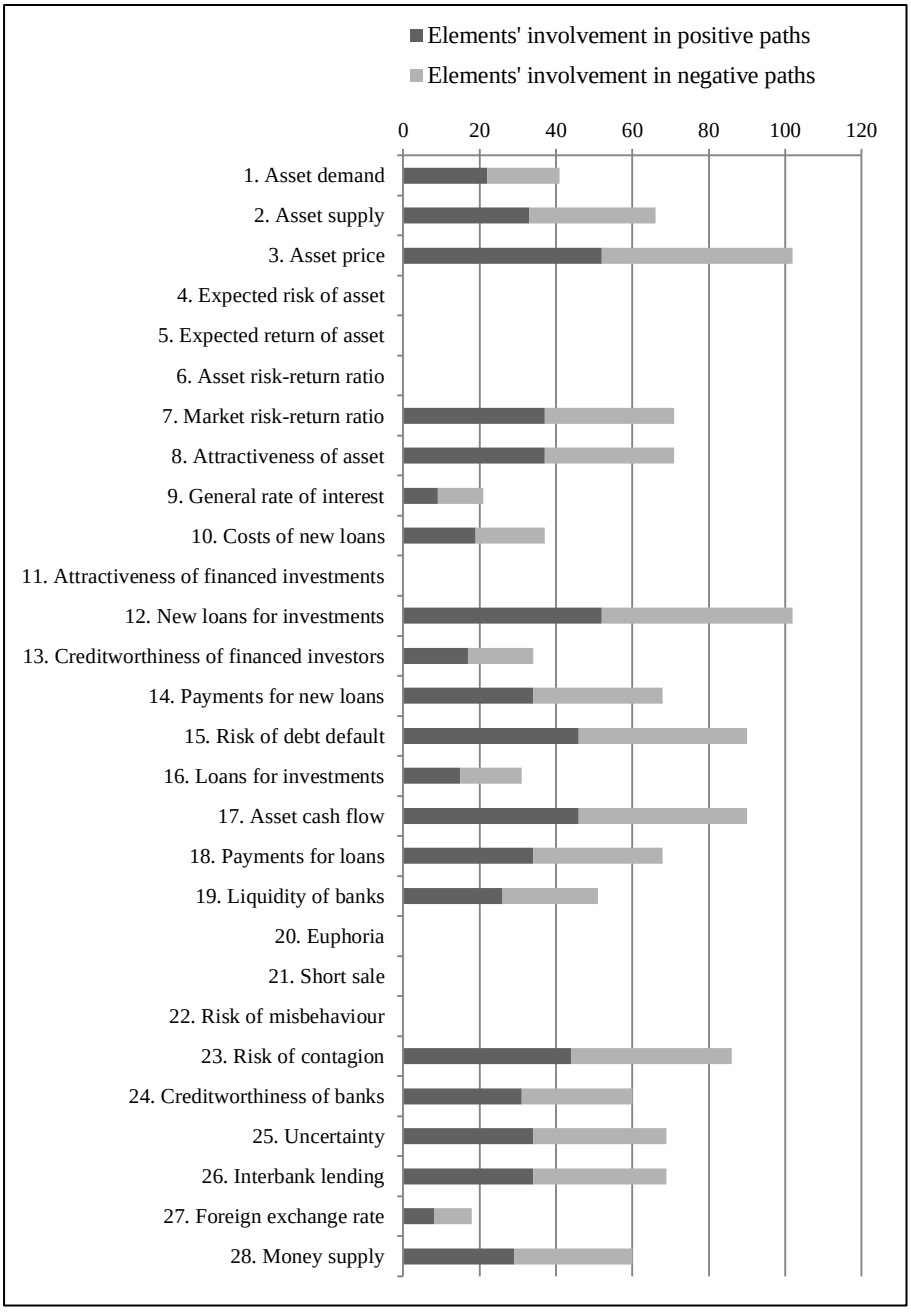


Figure 5-141: Involvement of elements in paths from Element 12 to Element 3 (from Element "New loans for investments" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "New loans for investments" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "New loans for investments" slightly decreases the Element "Asset price".

Paths from Element 12 (New loans for investments) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "New loans for investments" leads to an increase of the Element "Liquidity of banks" in 66 cases. In 70 cases the initial impulse of an increase of the Element "New loans for investments" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "New loans for investments" leads to a decrease of the Element "Liquidity of banks" in 66 cases. In 70 cases the initial impulse of a decrease of the Element "New loans for investments" leads to an increase of the Element "Liquidity of banks".

2.9% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 13.1 for positive paths and 13.5 for negative paths. The median is 13.0 for positive paths and 14.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-142 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

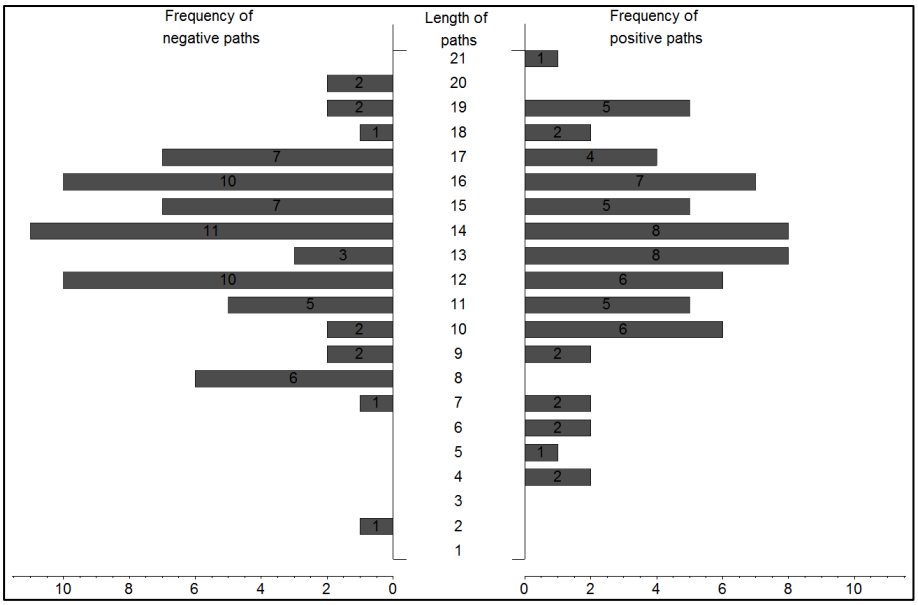


Figure 5-142: Length of paths from Element 12 to Element 19 (from Element "New loans for investments" to Element "Liquidity of banks")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 12 to Element 19. Indirectly, the Element "Risk of debt default" plays a significant role. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "General rate of interest", "Costs of new loans" and "Money supply" are more often involved in negative paths. The Elements "Market risk-return ratio" and "Attractiveness of asset" are more often involved in positive paths. Figure 5-143 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

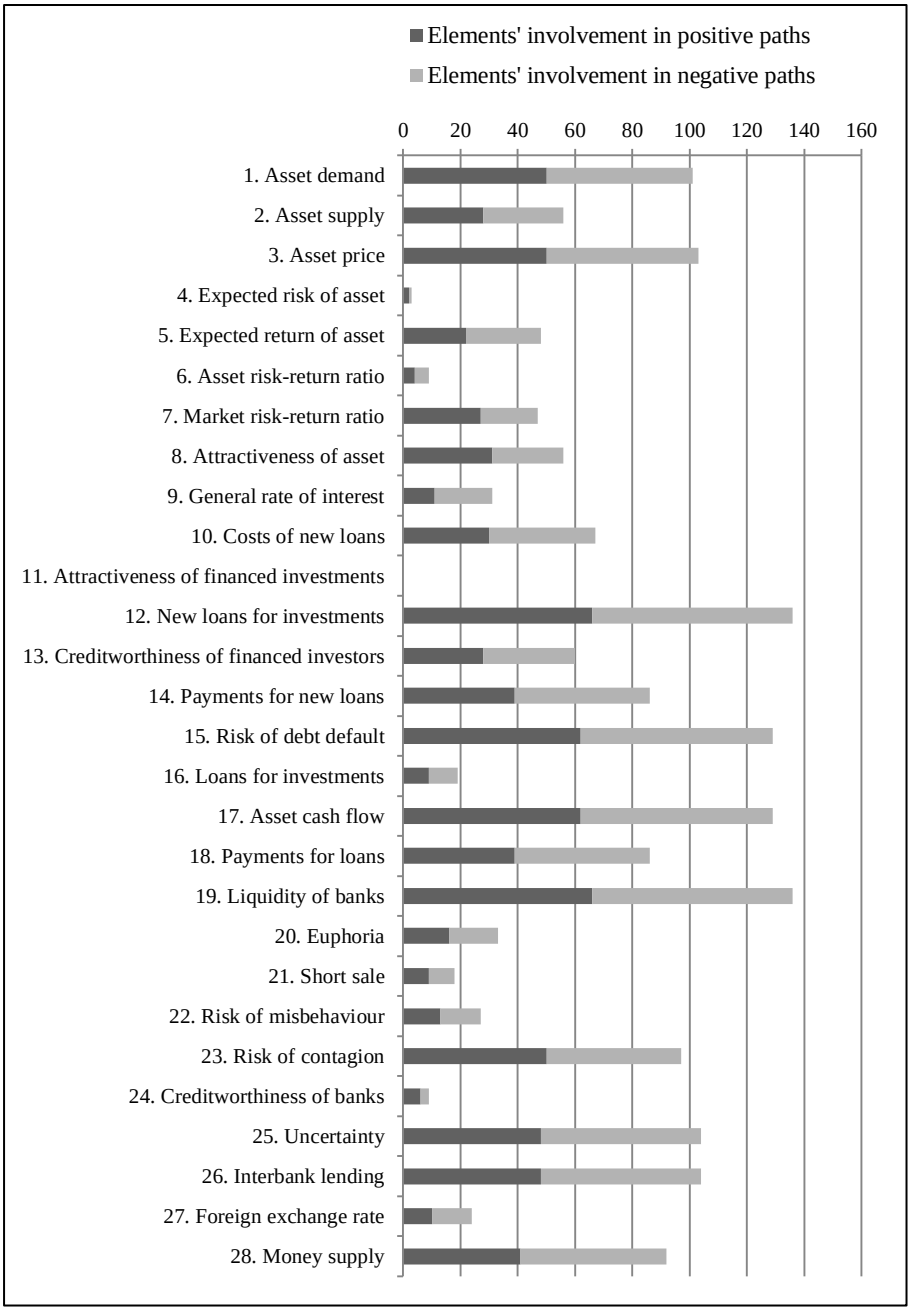


Figure 5-143: Involvement of elements in paths from Element 12 to Element 19 (from Element "New loans for investments" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "New loans for investments" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "New loans for investments" slightly increases the Element "Liquidity of banks".

Paths from Element 12 (New loans for investments) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "New loans for investments" leads to an increase of the Element "Foreign exchange rate" in 32 cases. In 34 cases the initial impulse of an increase of the Element "New loans for investments" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "New loans for investments" leads to a decrease of the Element "Foreign exchange rate" in 32 cases. In 34 cases the initial impulse of a decrease of the Element "New loans for investments" leads to an increase of the Element "Foreign exchange rate".

3.0% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

Positive paths are longer than negative paths. The mean is 17.3 for positive paths and 15.4 for negative paths. The median is 18.0 for positive paths and 16.0 for negative paths. The spreads of the lengths of positive paths and negative paths are identical. Figure 5-144 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

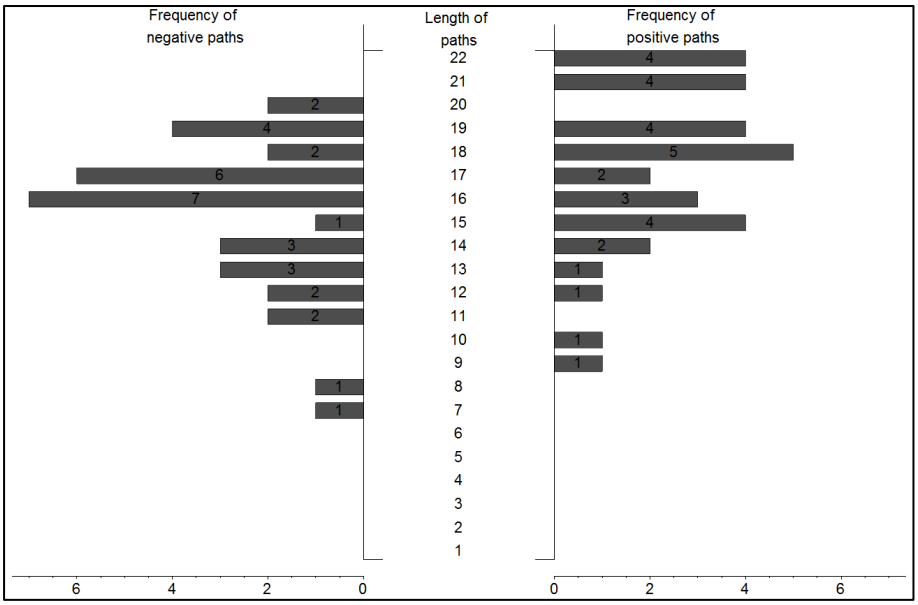


Figure 5-144: Length of paths from Element 12 to Element 27 (from Element "New loans for investments" to Element "Foreign exchange rate")

Next to other elements, the Element "Asset cash flow" is directly related and, therefore, more often involved in paths from Element 12 to Element 27. Indirectly, the Elements "Asset price", "Risk of debt default", "Risk of contagion", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Element "Asset demand" is more often involved in negative paths. The Elements "Market risk-return ratio", "Attractiveness of asset", "Payments for new loans" and "Payments for loans" are more often involved in positive paths. Figure 5-145 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

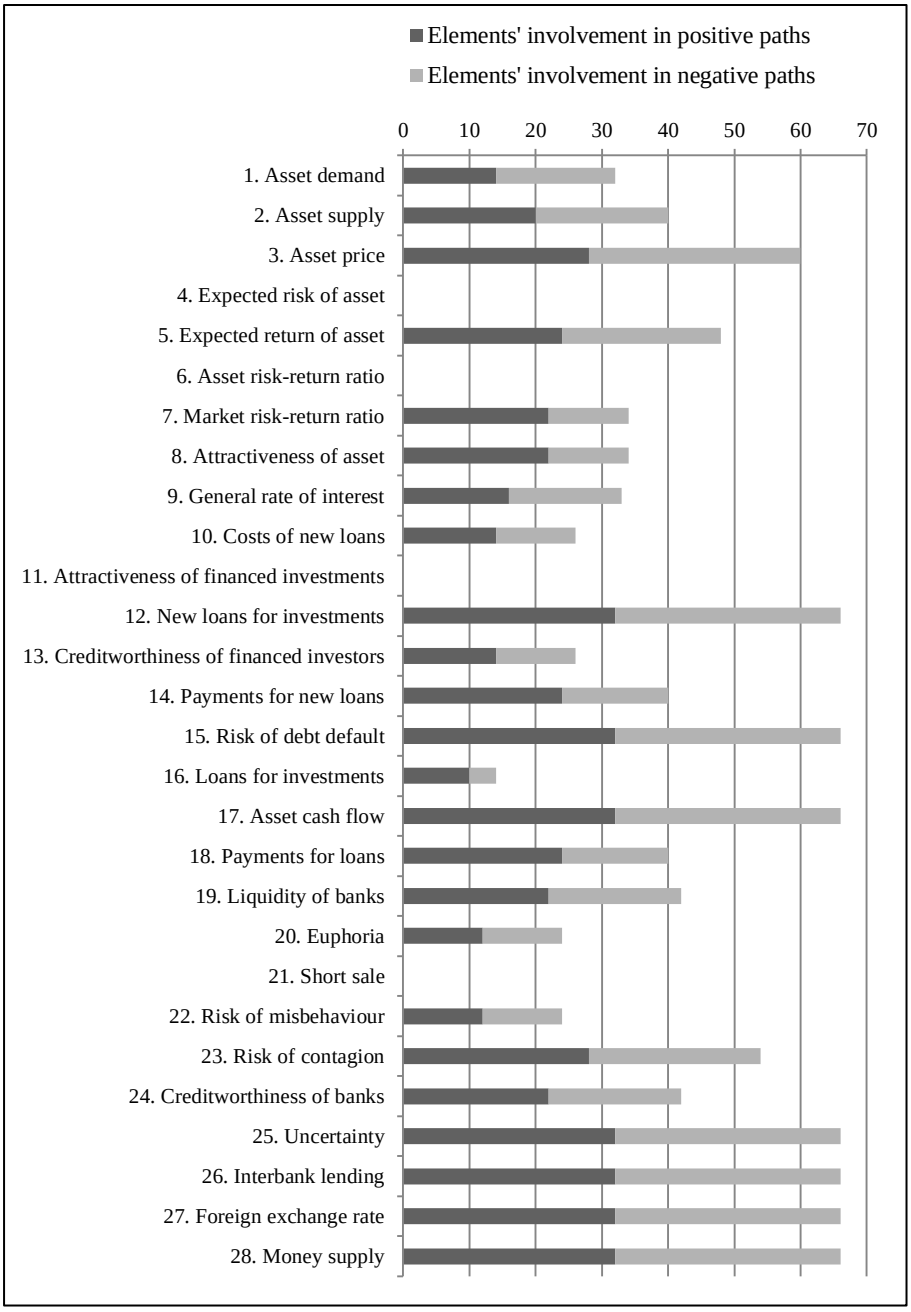


Figure 5-145: Involvement of elements in paths from Element 12 to Element 27 (from Element "New loans for investments" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "New loans for investments" slightly decreases the Element "Foreign exchange rate" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed

that the initial impulse of increasing the Element "New loans for investments" decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "New loans for investments" slightly increases the Element "Foreign exchange rate" according to the number of positive and negative paths. In addition, the length of negative paths is shorter than the length of positive paths, which intensives the effects of negative paths. Therefore, it is assumed that the initial impulse of decrease the Element "New loans for investments" increases the Element "Foreign exchange rate".

Paths from Element 13 (Creditworthiness of financed investors) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Asset price" in 66 cases. In 64 cases the initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Asset price" in 66 cases. In 64 cases the initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Asset price".

1.5% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 14.0 for positive paths and 14.2 for negative paths. The median is 14.0 for positive paths and 15.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-146 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

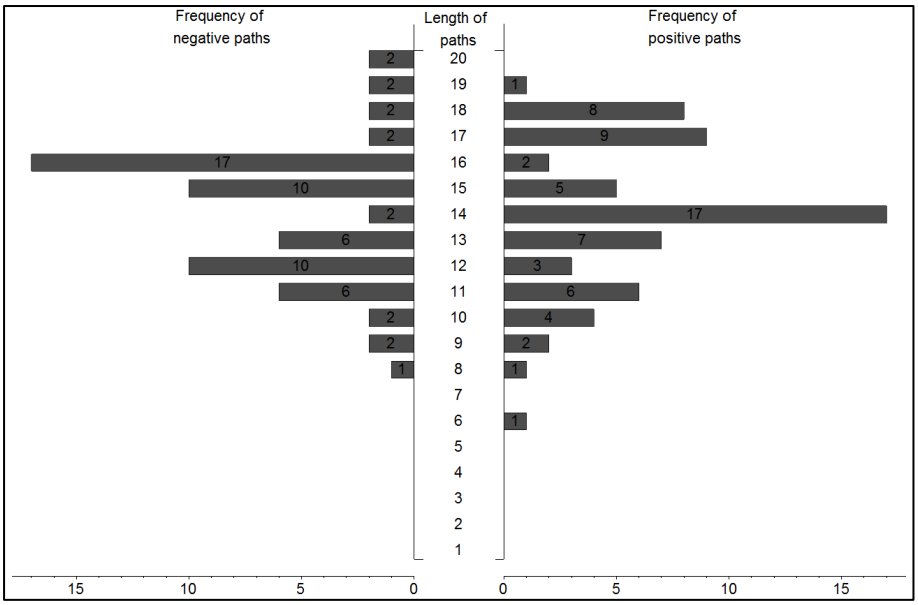


Figure 5-146: Length of paths from Element 13 to Element 3 (from Element "Creditworthiness of financed investors" to Element "Asset price")

The Element "Costs of new loans" is directly related and, therefore, more often involved in paths from Element 13 to Element 3. Indirectly, the Elements "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-147 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

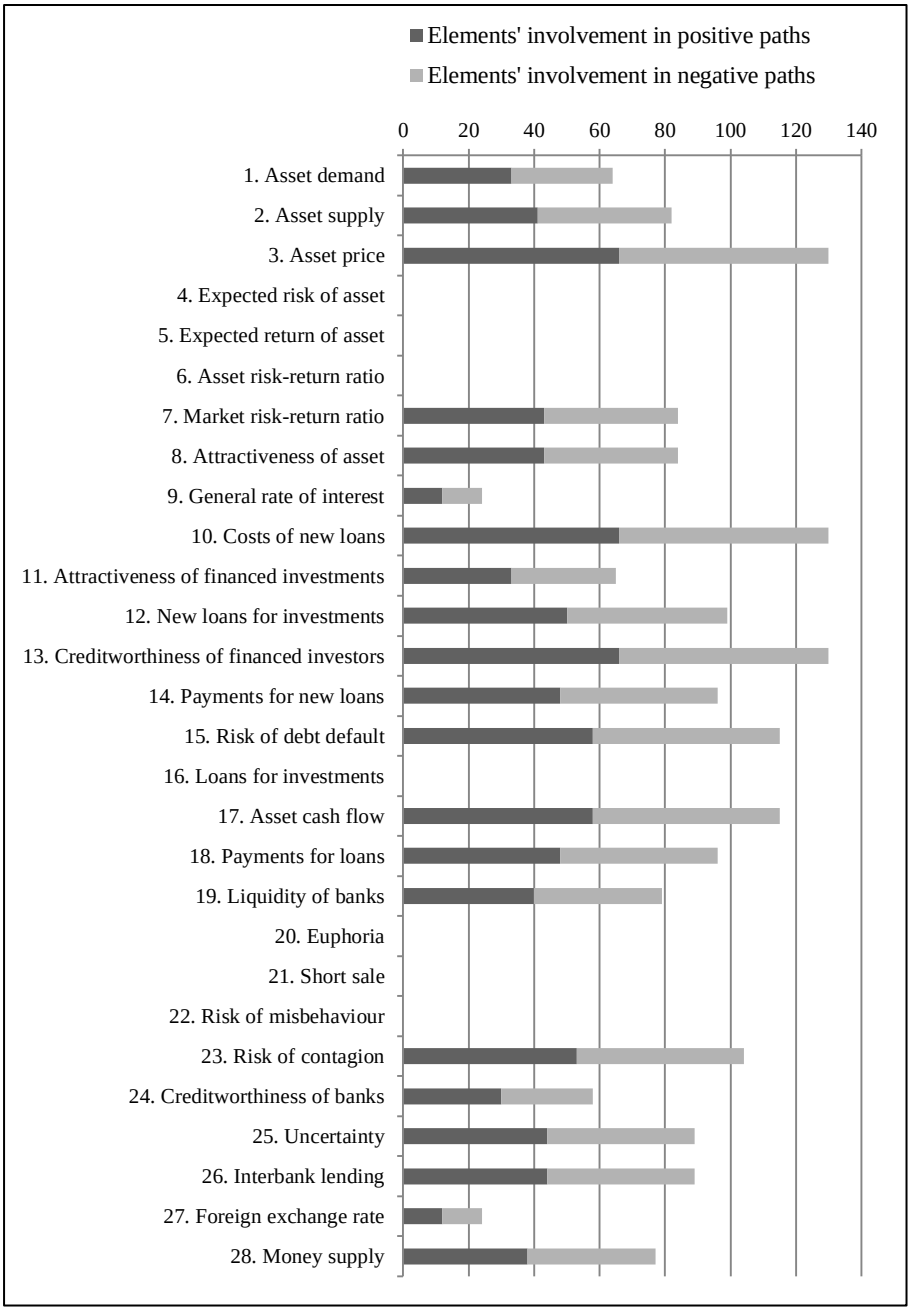


Figure 5-147: Involvement of elements in paths from Element 13 to Element 3 (from Element "Creditworthiness of financed investors" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of financed investors" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Creditworthiness of financed investors" slightly decreases the Element "Asset price".

Paths from Element 13 (Creditworthiness of financed investors) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Liquidity of banks" in 66 cases. In 60 cases the initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Liquidity of banks" in 66 cases. In 60 cases the initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Liquidity of banks".

4.8% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.4 for positive paths and 15.9 for negative paths. The median is 16.0 for positive paths and 17.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-148 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

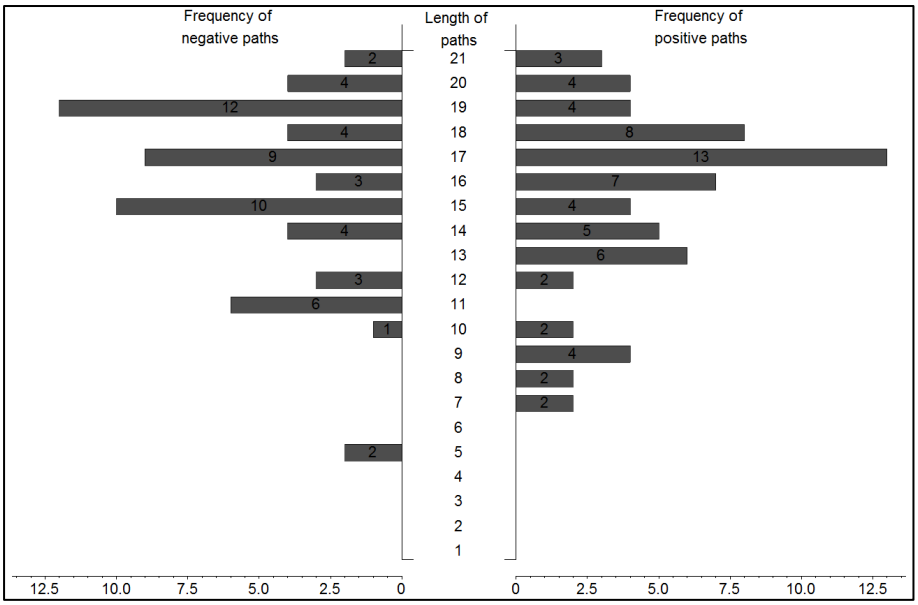


Figure 5-148: Length of paths from Element 13 to Element 19 (from Element "Creditworthiness of financed investors" to Element "Liquidity of banks")

The Element "Costs of new loans" is directly related and, therefore, more often involved in paths from Element 13 to Element 19. Indirectly, the Elements "Attractiveness of financed investments", "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-149 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

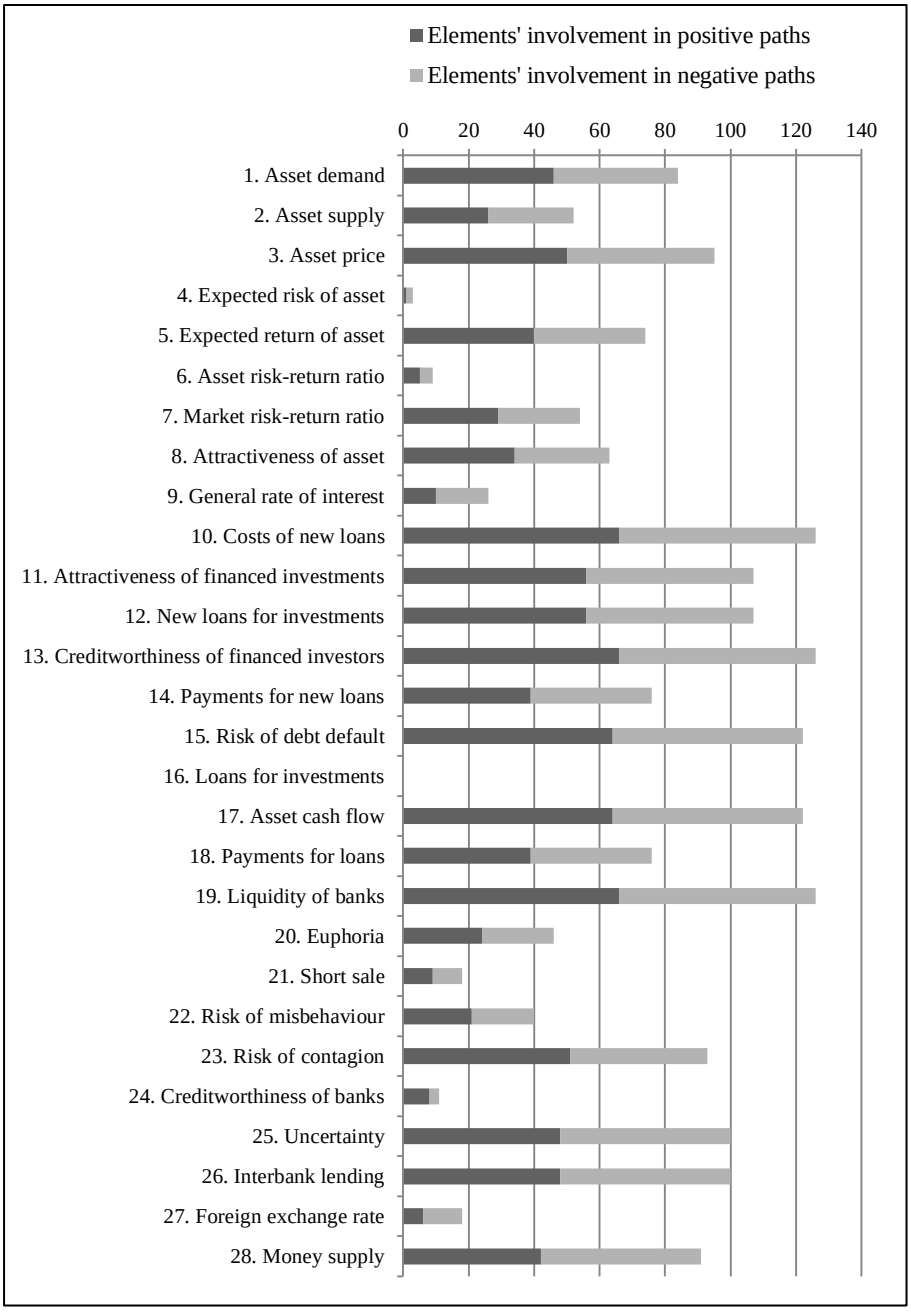


Figure 5-149: Involvement of elements in paths from Element 13 to Element 19 (from Element "Creditworthiness of financed investors" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of financed investors" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Creditworthiness of financed investors" slightly decreases the Element "Liquidity of banks".

Paths from Element 13 (Creditworthiness of financed investors) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Foreign exchange rate" in 36 cases. In 44 cases the initial impulse of an increase of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to a decrease of the Element "Foreign exchange rate" in 36 cases. In 44 cases the initial impulse of a decrease of the Element "Creditworthiness of financed investors" leads to an increase of the Element "Foreign exchange rate".

10.0% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 18.2 for positive paths and 18.4 for negative paths. The median is 18.0 for positive paths and 19.5 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-150 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

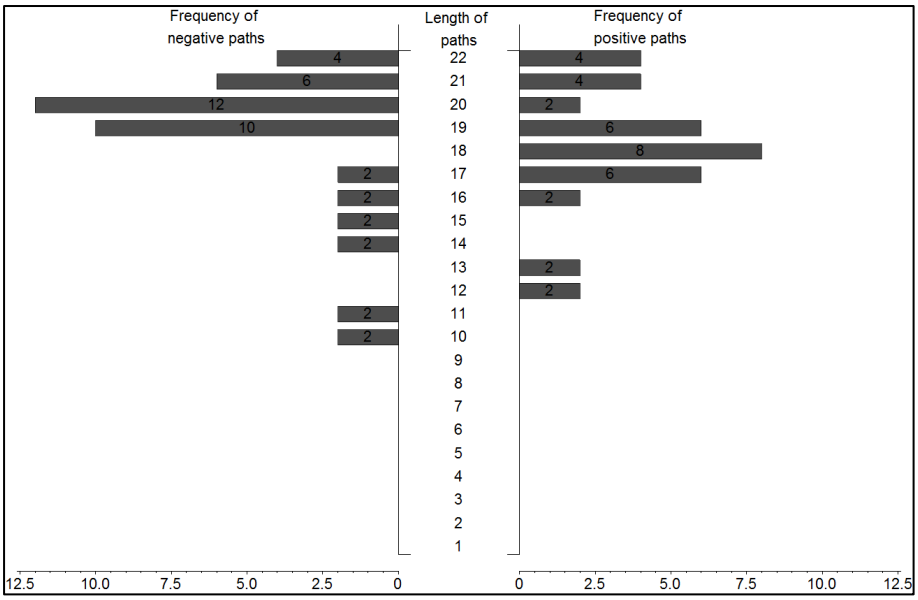


Figure 5-150: Length of paths from Element 13 to Element 27 (from Element "Creditworthiness of financed investors" to Element "Foreign exchange rate")

The Element "Costs of new loans" is directly related and, therefore, more often involved in paths from Element 13 to Element 27. Indirectly, the Elements "Asset price", "Expected return of asset", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Asset demand", "Asset price", "Expected return of asset", "Market risk-return ratio", "Attractiveness of asset", "Attractiveness of financed investments", "Euphoria", "Risk of misbehaviour", "Risk of contagion" and "Creditworthiness of banks" are more often involved in negative paths. Figure 5-151 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

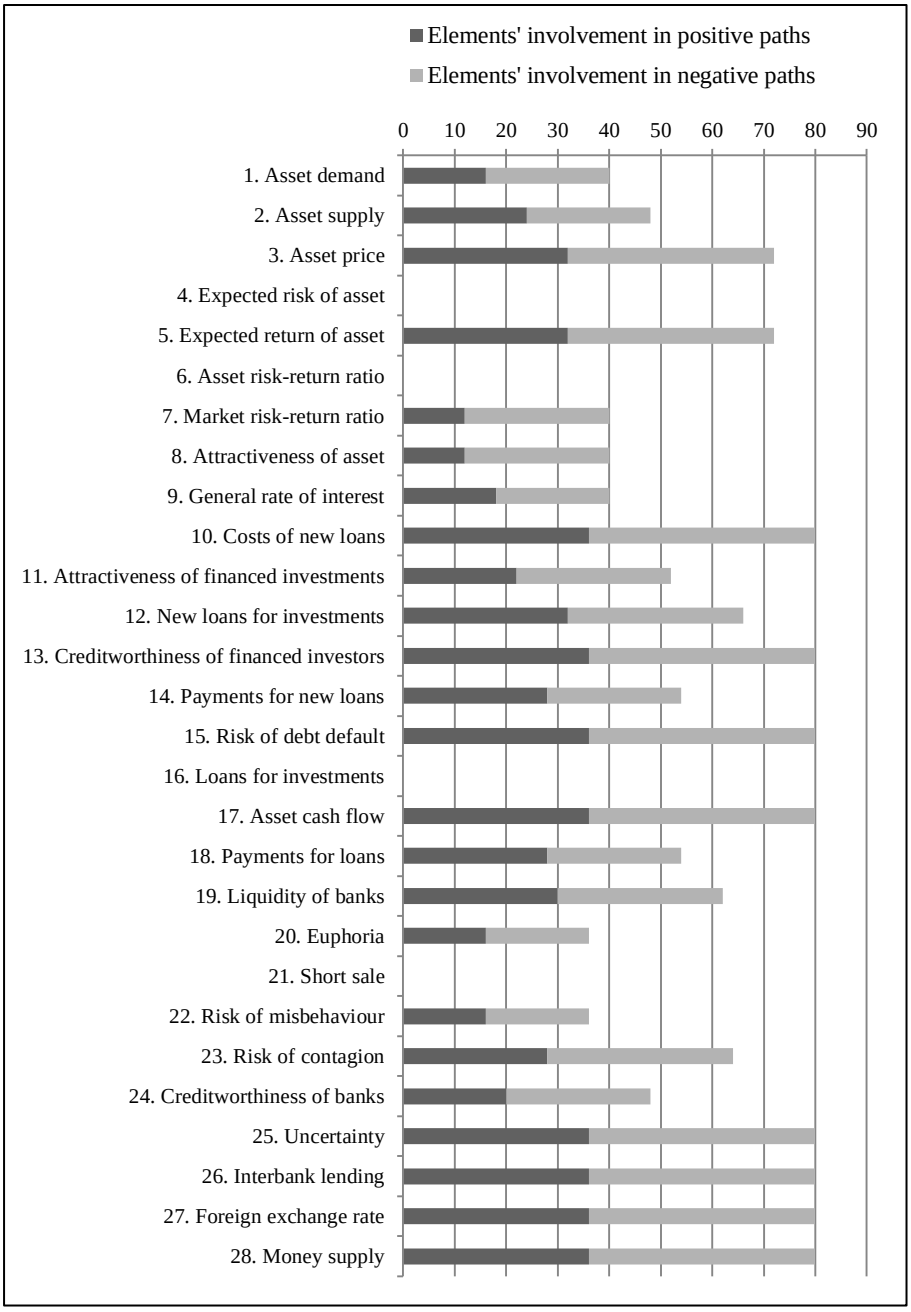


Figure 5-151: Involvement of elements in paths from Element 13 to Element 27 (from Element "Creditworthiness of financed investors" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Creditworthiness of financed investors" decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Creditworthiness of financed investors" increases the Element "Foreign exchange rate".

Paths from Element 14 (Payments for new loans) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Payments for new loans" leads to an increase of the Element "Asset price" in 54 cases. In 57 cases the initial impulse of an increase of the Element "Payments for new loans" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Payments for new loans" leads to a decrease of the Element "Asset price" in 54 cases. In 57 cases the initial impulse of a decrease of the Element "Payments for new loans" leads to an increase of the Element "Asset price".

2.7% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 13.5 for both. The median is 14.0 for positive paths and 13.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-152 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

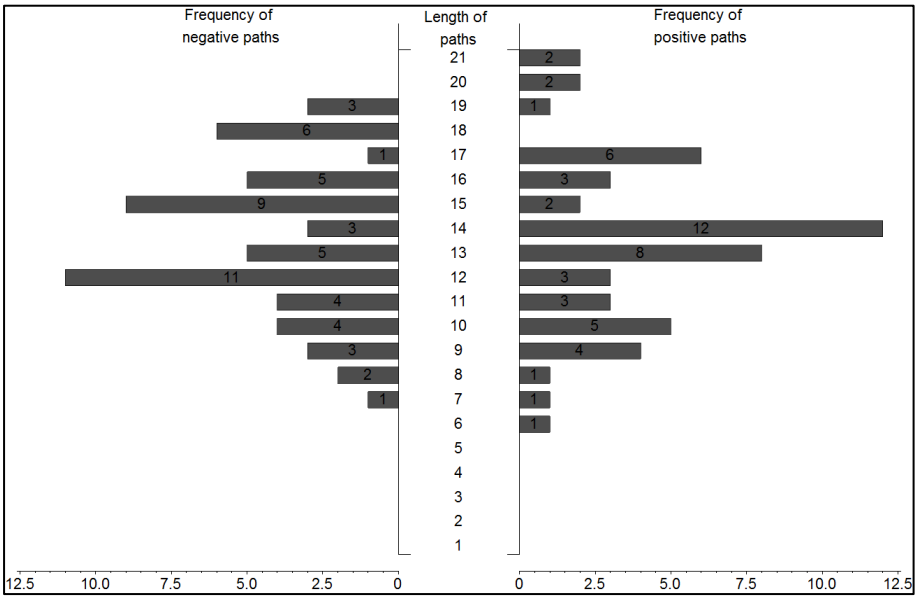


Figure 5-152: Length of paths from Element 14 to Element 3 (from Element "Payments for new loans" to Element "Asset price")

The Element "Payments for loans" is directly related and, therefore, more often involved in paths from Element 14 to Element 3. Indirectly,

the Elements “Risk of debt default”, “Asset cash flow” and “Risk of contagion” play significant roles. Elements are equally involved in positive and negative paths. Figure 5-153 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

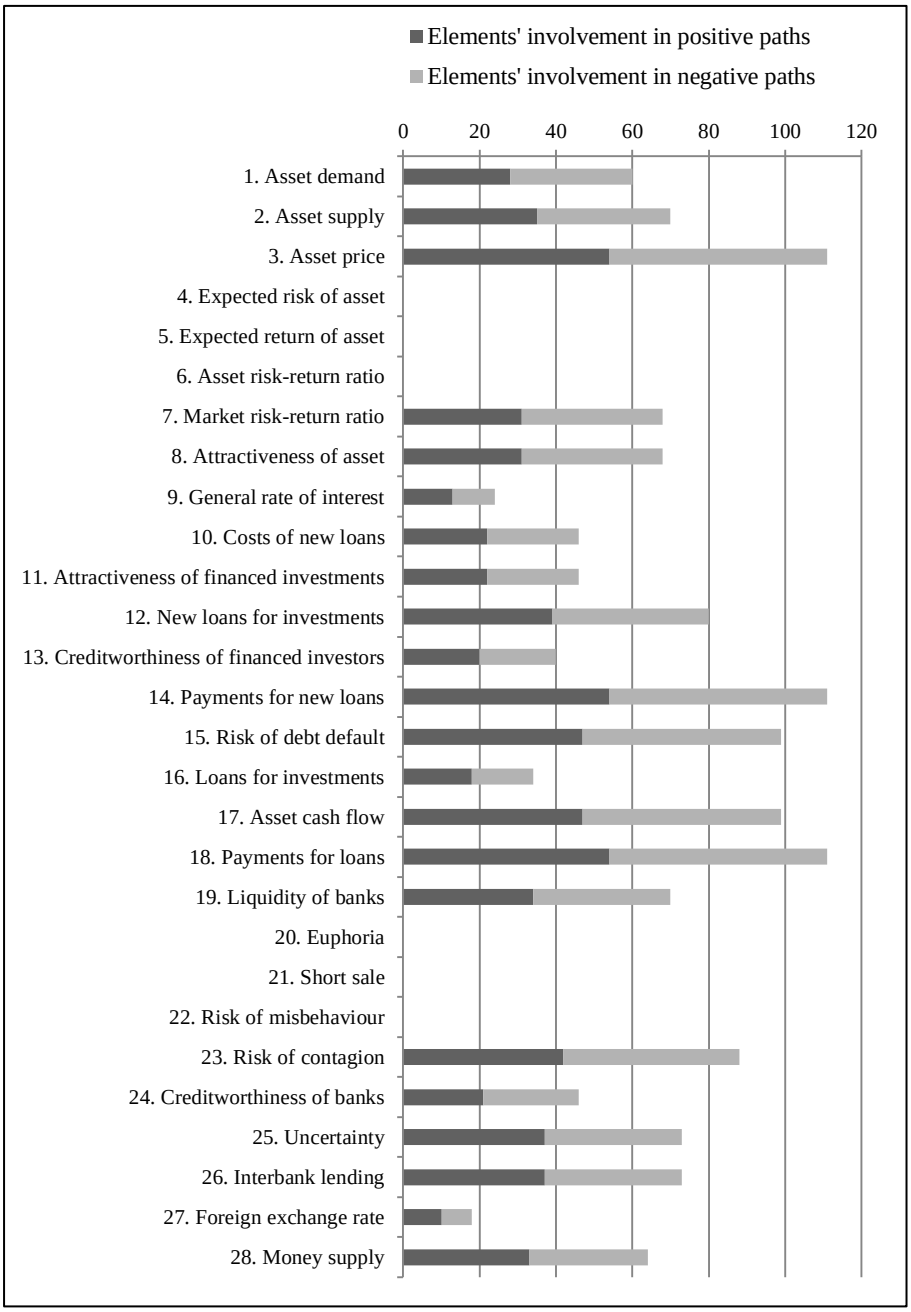


Figure 5-153: Involvement of elements in paths from Element 14 to Element 3 (from Element “Payments for new loans” to Element “Asset price”)

Interpretation: The initial impulse of increasing the Element “Payments for new loans” slightly decreases the Element “Asset price”.

The initial impulse of decreasing the Element “Payments for new loans” slightly increases the Element “Asset price”.

Paths from Element 14 (Payments for new loans) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element “Payments for new loans” leads to an increase of the Element “Liquidity of banks” in 65 cases. In 65 cases the initial impulse of an increase of the Element “Payments for new loans” leads to a decrease of the Element “Liquidity of banks”.

The initial impulse of a decrease of the Element “Payments for new loans” leads to a decrease of the Element “Liquidity of banks” in 65 cases. In 65 cases the initial impulse of a decrease of the Element “Payments for new loans” leads to an increase of the Element “Liquidity of banks”.

For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.7 for positive paths and 15.9 for negative paths. The median is 17.0 for positive paths and 16.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-154 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

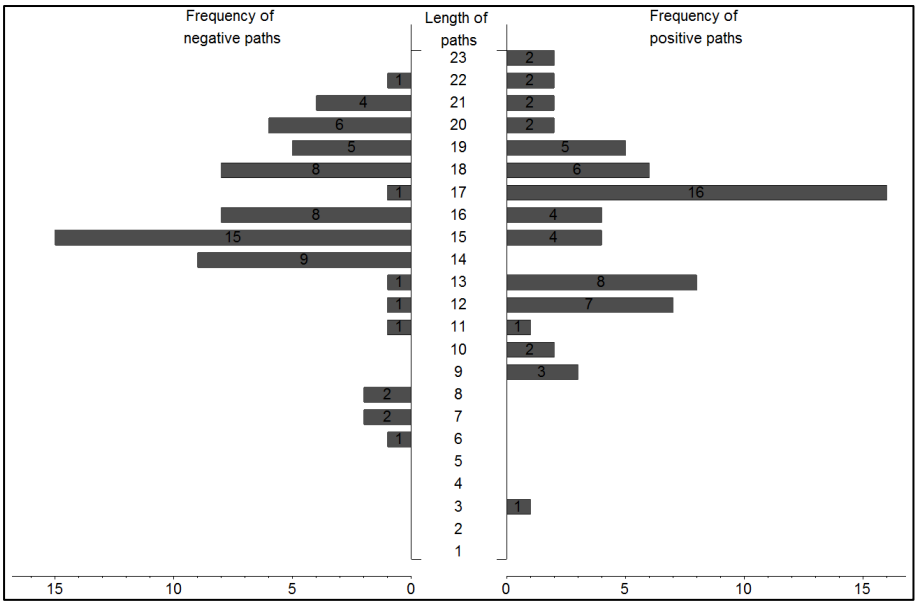


Figure 5-154: Length of paths from Element 14 to Element 19 (from Element "Payments for new loans" to Element "Liquidity of banks")

The Element "Payments for loans" is directly related and, therefore, more often involved in paths from Element 14 to Element 19. Indirectly, the Elements "Asset price", "Attractiveness of financed investments", "New loans for investments", "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-155 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

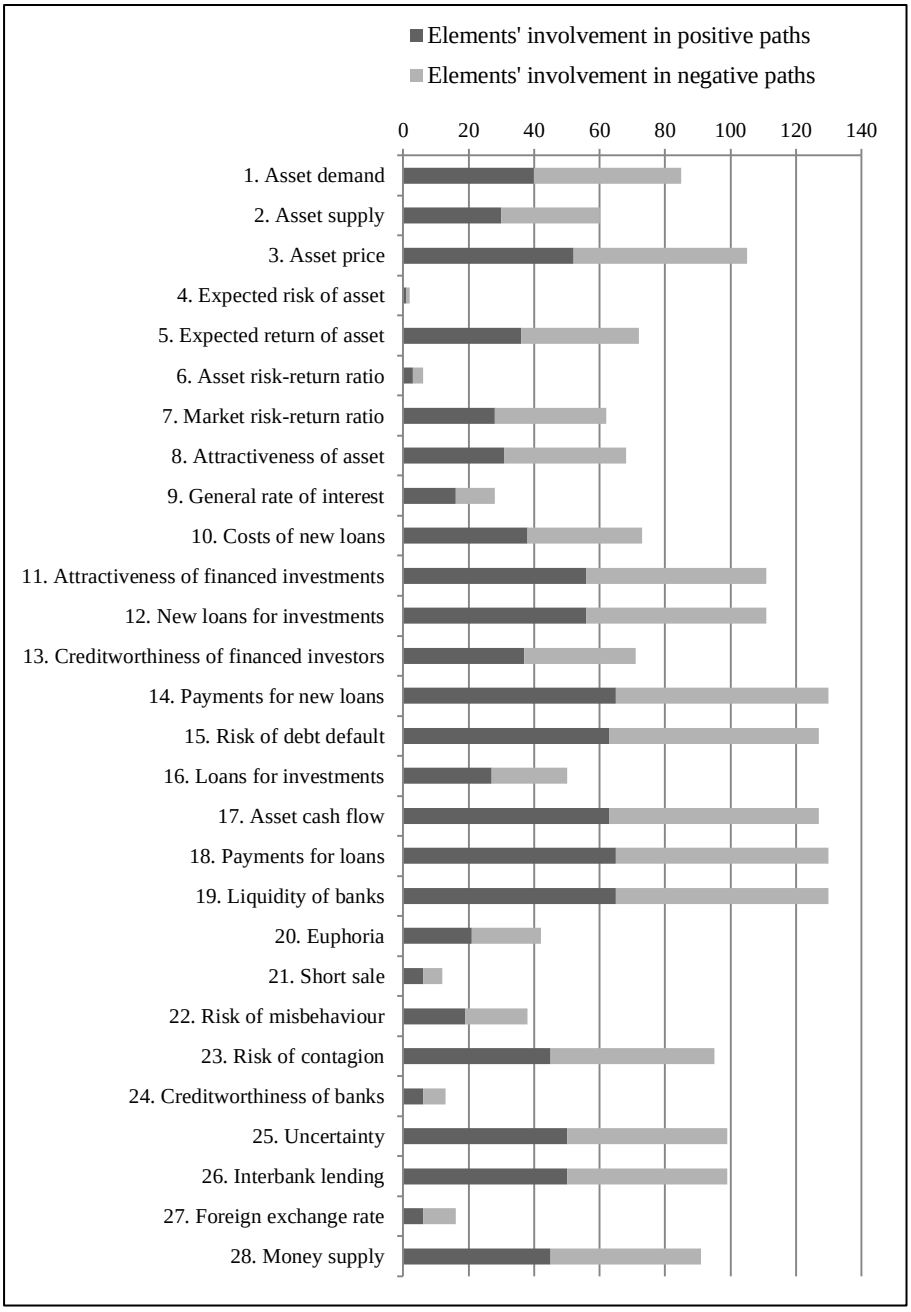


Figure 5-155: Involvement of elements in paths from Element 14 to Element 19 (from Element "Payments for new loans" to Element "Liquidity of banks")

Interpretation: The initial impulses of increasing or decreasing the Element "Payments for new loans" have no effects on the Element "Liquidity of banks".

Paths from Element 14 (Payments for new loans) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Payments for new loans" leads to an increase of the Element "Foreign exchange rate" in 34 cases. In 38 cases the initial impulse of an increase of the Element "Payments for new loans" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Payments for new loans" leads to a decrease of the Element "Foreign exchange rate" in 34 cases. In 38 cases the initial impulse of a decrease of the Element "Payments for new loans" leads to an increase of the Element "Foreign exchange rate".

5.6% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 18.6 for positive paths and 17.6 for negative paths. The median is 19.0 for positive paths and 17.0 for negative paths. The spreads of the lengths of positive paths and of negative paths are similar. Figure 5-156 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

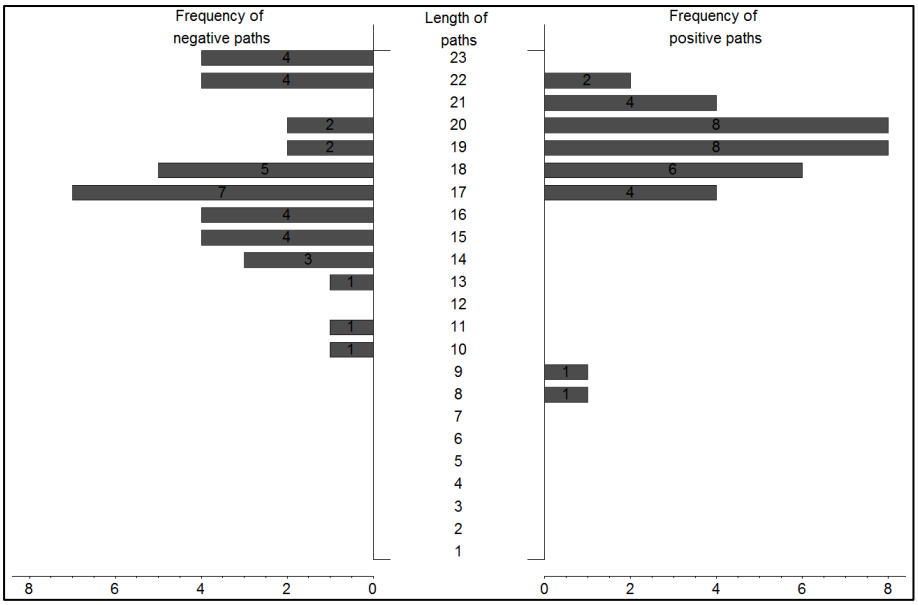


Figure 5-156: Length of paths from Element 14 to Element 27 (from Element "Payments for new loans" to Element "Foreign exchange rate")

The Element "Payments for loans" is directly related and, therefore, more often involved in paths from Element 14 to Element 27. Indirectly, the Elements "Asset price", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Market risk-return ratio", "Attractiveness of asset", "Risk of contagion" and "Creditworthiness of banks" are more often involved in positive paths. The Elements "Costs of new loans", "New loans for investments" and "Creditworthiness of financed investors are more often involved in negative paths. Figure 5-157 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

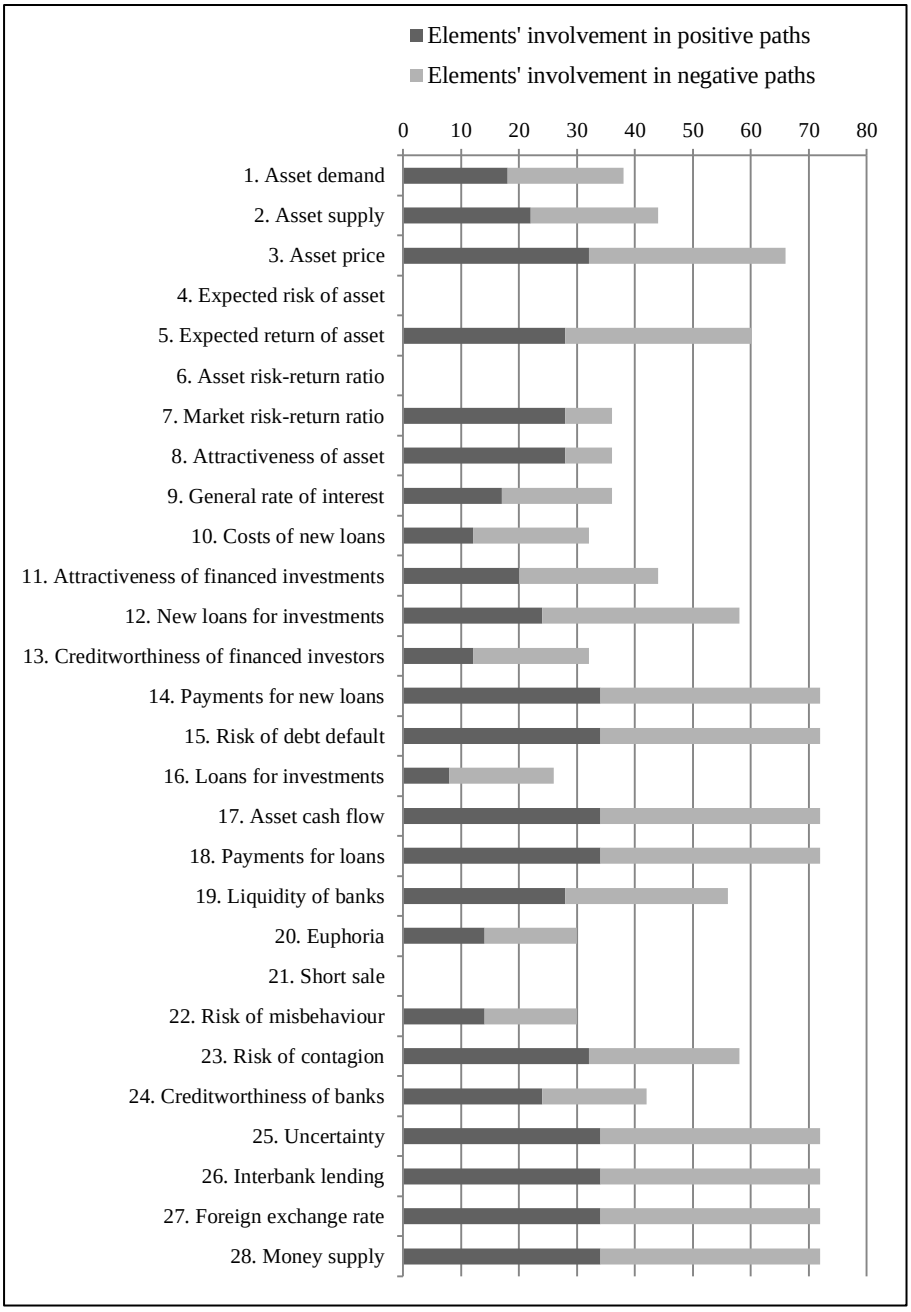


Figure 5-157: Involvement of elements in paths from Element 14 to Element 27 (from Element "Payments for new loans" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Payments for new loans" decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Payments for new loans" increases the Element "Foreign exchange rate".

Paths from Element 15 (Risk of debt default) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Risk of debt default" leads to an increase of the Element "Asset price" in 35 cases. In 38 cases the initial impulse of an increase of the Element "Risk of debt default" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Risk of debt default" leads to a decrease of the Element "Asset price" in 35 cases. In 38 cases the initial impulse of a decrease of the Element "Risk of debt default" leads to an increase of the Element "Asset price".

4.1% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 10.7 for positive paths and 10.6 for negative paths. The median is 11.0 for positive paths and 11.5 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-158 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

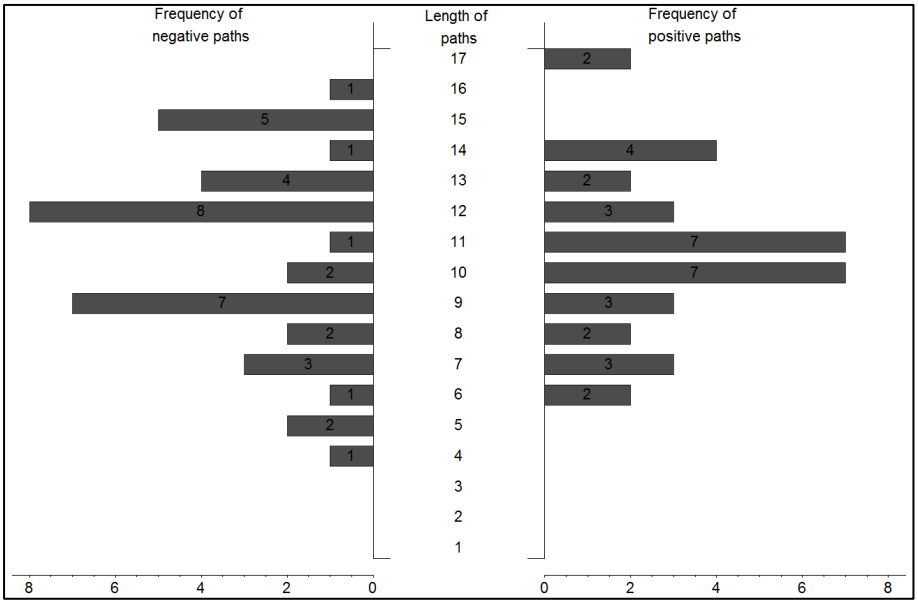


Figure 5-158: Length of paths from Element 15 to Element 3 (from Element "Risk of debt default" to Element "Asset price")

Next to other elements, the Element "Risk of contagion" is directly related and, therefore, more often involved in paths from Element 15 to Element 3. Elements are equally involved in positive and negative paths. Figure 5-159 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

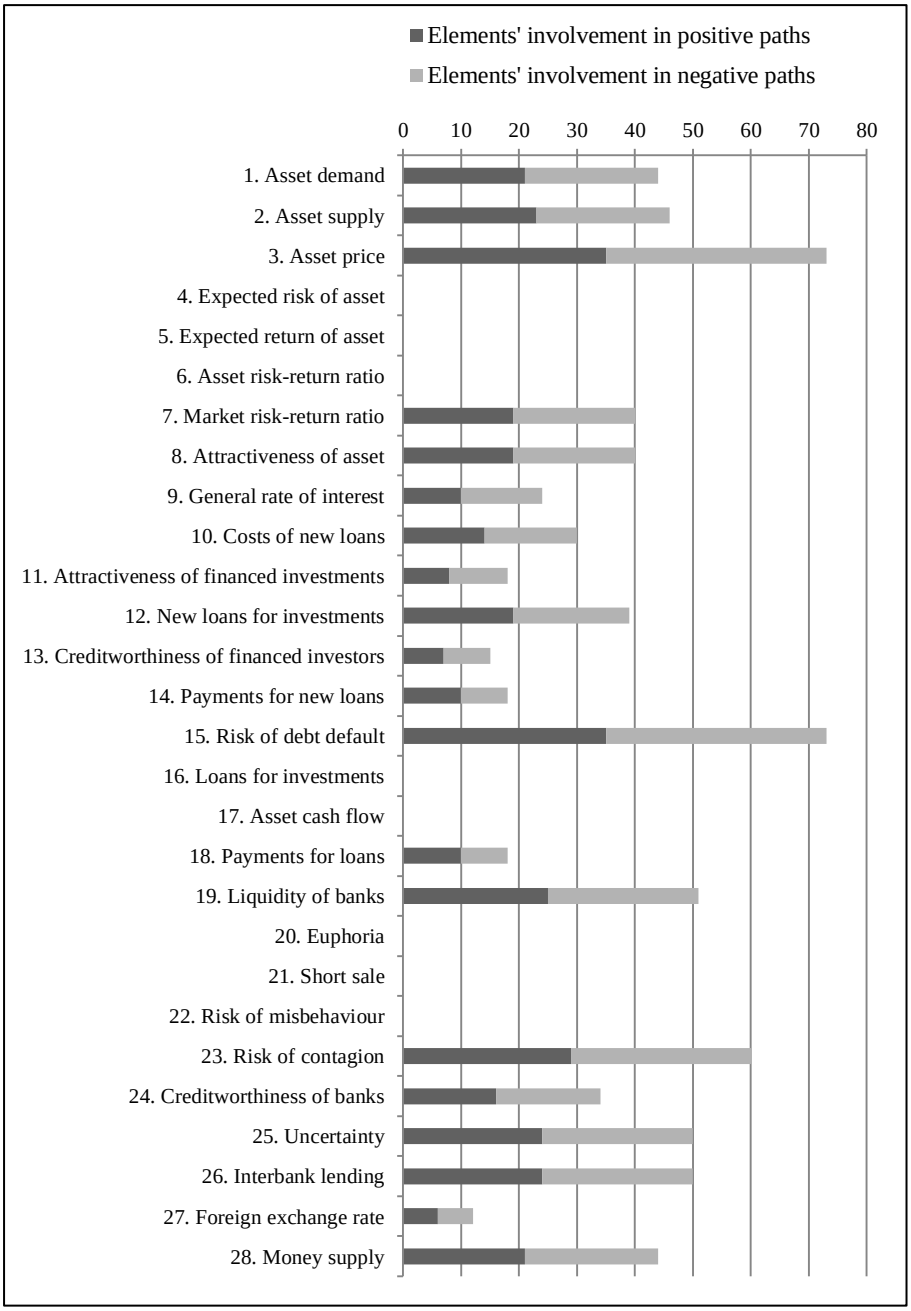


Figure 5-159: Involvement of elements in paths from Element 15 to Element 3 (from Element "Risk of debt default" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Risk of debt default" slightly decreases the Element "Asset price".

The initial impulse of decreasing the Element "Risk of debt default" slightly increases the Element "Asset price".

Paths from Element 15 (Risk of debt default) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Risk of debt default" leads to an increase of the Element "Liquidity of banks" in 87 cases. In 92 cases the initial impulse of an increase of the Element "Risk of debt default" leads to a decrease of the Element "Liquidity of banks".
The initial impulse of a decrease of the Element "Risk of debt default" leads to a decrease of the Element "Liquidity of banks" in 87 cases. In 92 cases the initial impulse of a decrease of the Element "Risk of debt default" leads to an increase of the Element "Liquidity of banks".
2.8% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. Shorter negative paths are equalised by longer negative paths. The mean is 13.5 for positive paths and 13.4 for negative paths. The median is 14.0 for positive paths and 13.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-160 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

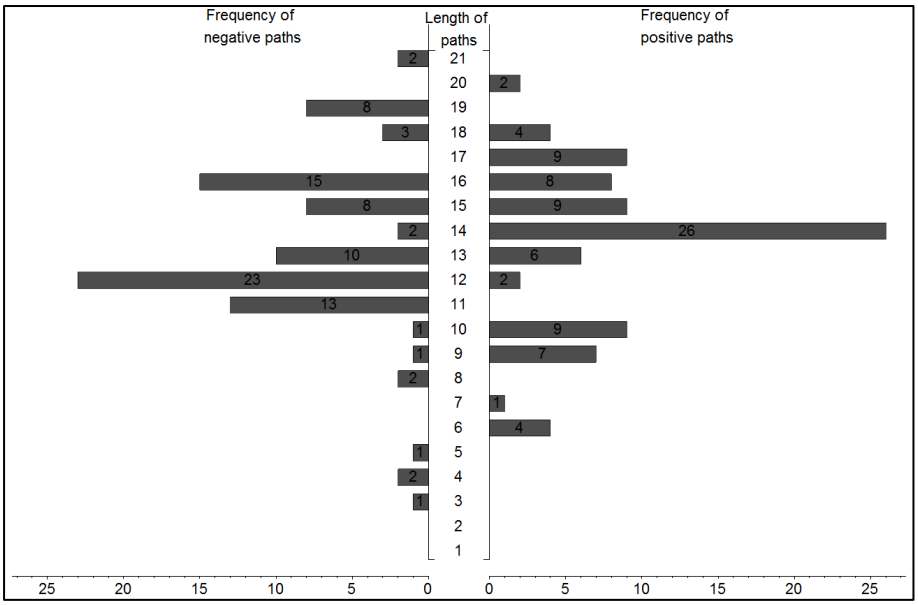


Figure 5-160: Length of paths from Element 15 to Element 19 (from Element "Risk of debt default" to Element "Liquidity of banks")

Indirectly, the Element "Asset price" plays a significant role in paths from Element 15 to Element 19. In general, elements are equally involved in positive and negative paths. However, there is one significant exception. The Element "General rate of interest" is more often involved in negative paths. Figure 5-161 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

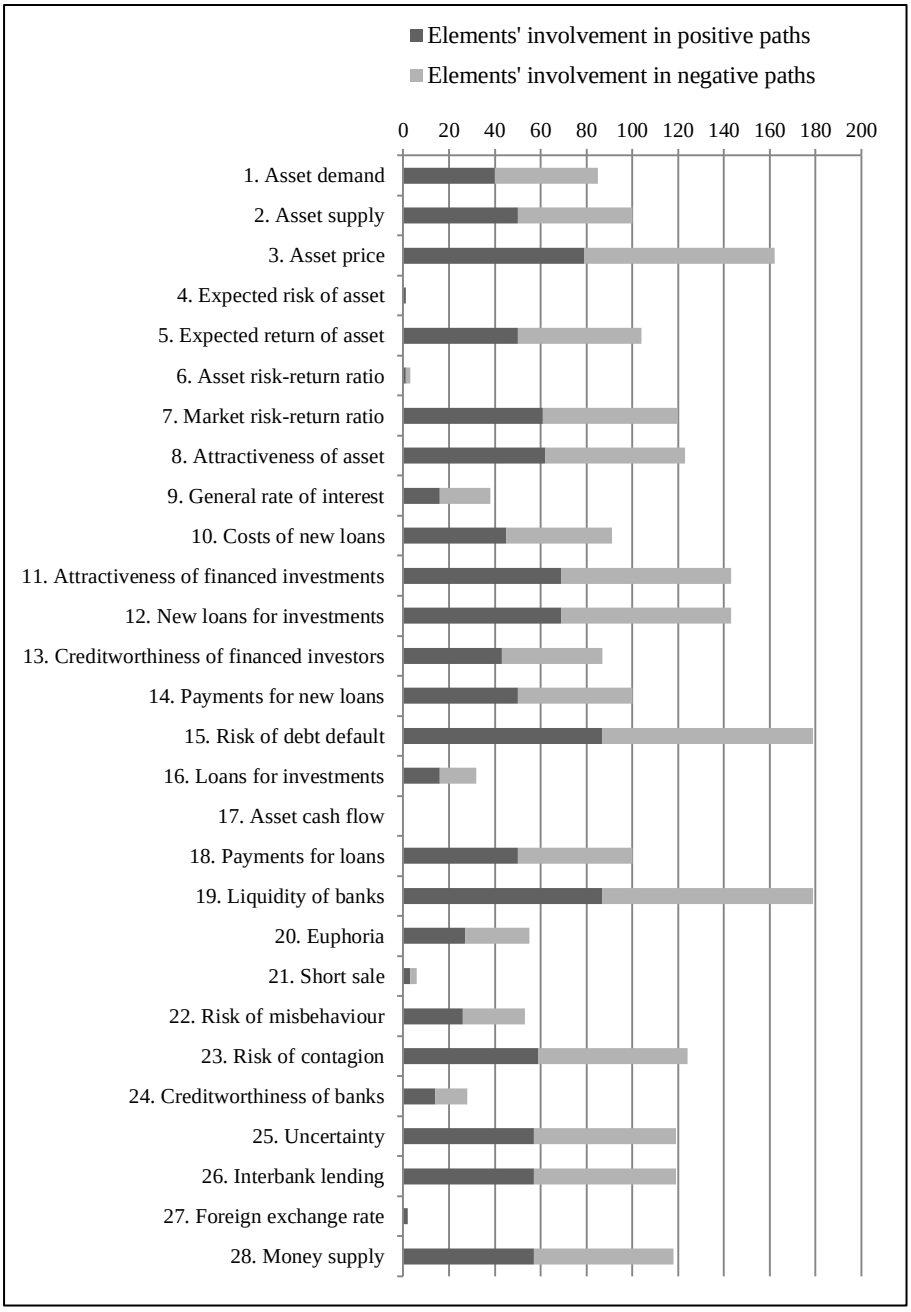


Figure 5-161: Involvement of elements in paths from Element 15 to Element 19 (from Element "Risk of debt default" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Risk of debt default" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Risk of debt default" slightly increases the Element "Liquidity of banks".

Paths from Element 15 (Risk of debt default) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Risk of debt default" leads to an increase of the Element "Foreign exchange rate" in 2 cases. In 0 cases the initial impulse of an increase of the Element "Risk of debt default" leads to a decrease of the Element "Foreign exchange rate.

The initial impulse of a decrease of the Element "Risk of debt default" leads to a decrease of the Element "Foreign exchange rate" in 2 cases. In 0 cases the initial impulse of a decrease of the Element "Risk of debt default" leads to an increase of the Element "Foreign exchange rate.

For a detailed list of paths please refer to Appendix 4.

Interpretation: The initial impulse of increasing the Element "Risk of debt default" increases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Risk of debt default" decreases the Element "Foreign exchange rate".

Paths from Element 16 (Loans for investments) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Loans for investments" leads to an increase of the Element "Asset price" in 64 cases. In 66 cases the initial impulse of an increase of the Element "Loans for investments" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Loans for investments" leads to a decrease of the Element "Asset price" in 64 cases. In 66 cases the initial impulse of a decrease of the Element "Loans for investments" leads to an increase of the Element "Asset price".

1.5% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean

is 15.2 for positive paths and 15.0 for negative paths. The median is 16.0 for positive paths and 15.0 for negative paths. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-162 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

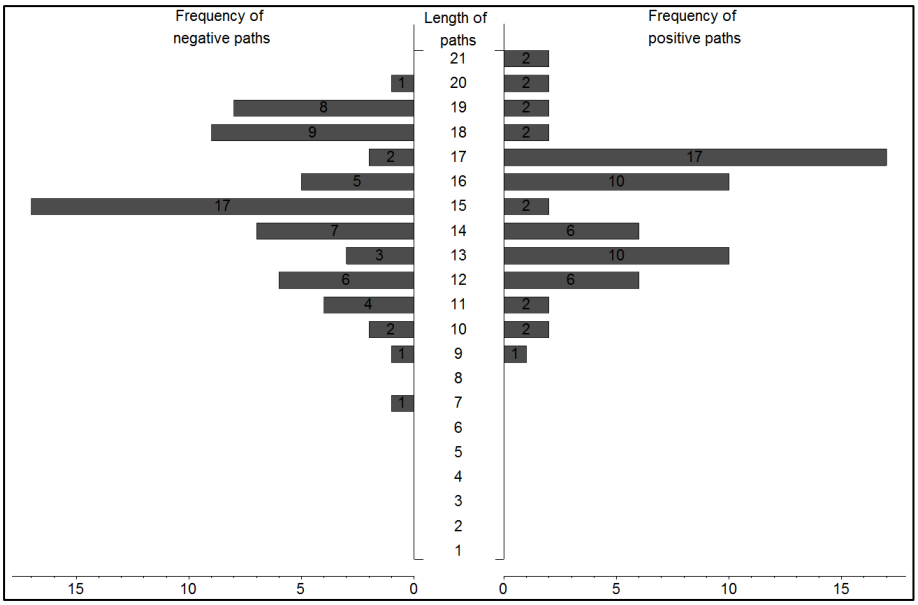


Figure 5-162: Length of paths from Element 16 to Element 3 (from Element "Loans for investments" to Element "Asset price")

The Element "Creditworthiness of financed investors" is directly related and, therefore, more often involved in paths from Element 16 to Element 3. Indirectly, the Elements "Costs of new loans", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-163 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

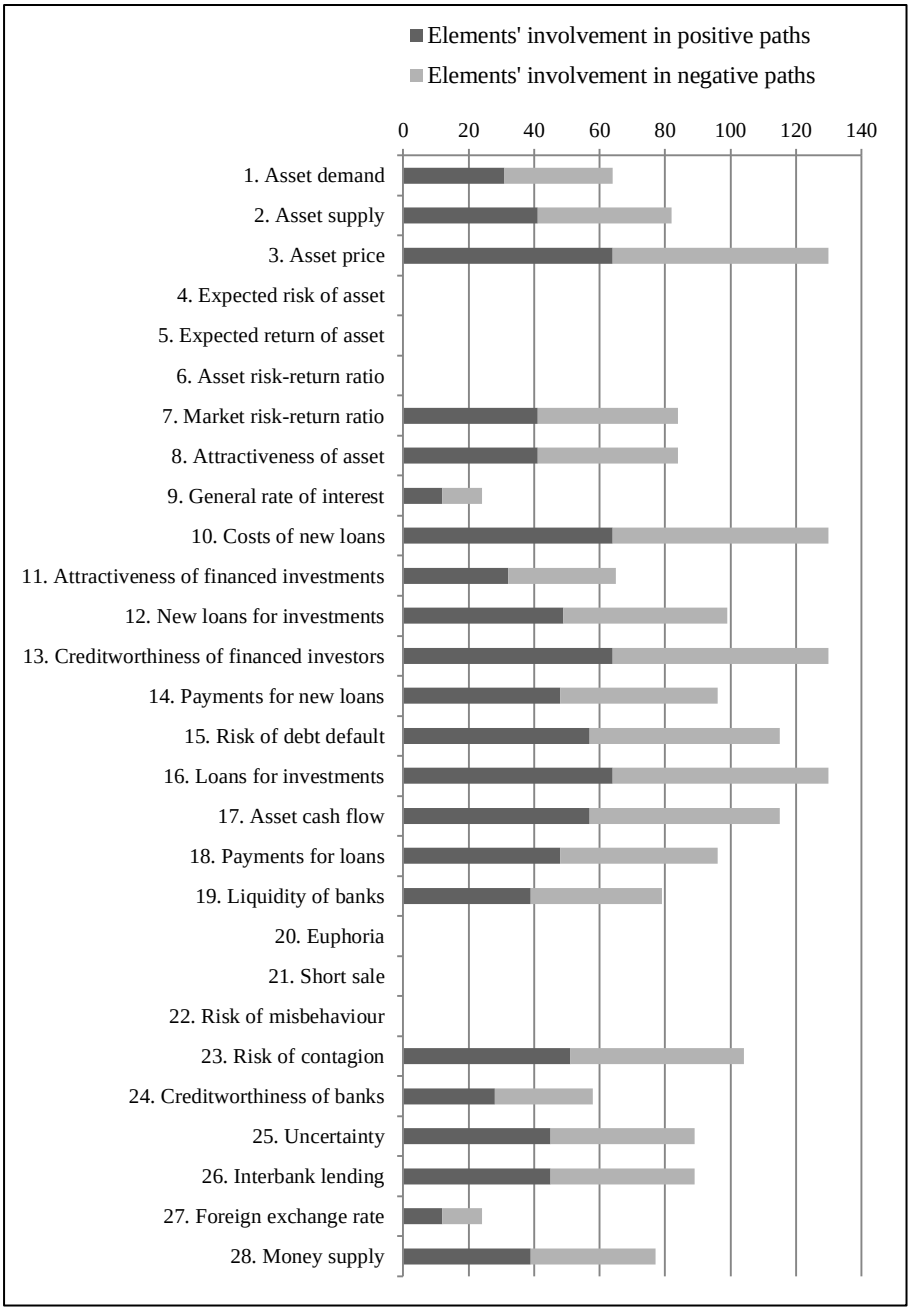


Figure 5-163: Involvement of elements in paths from Element 16 to Element 3 (from Element "Loans for investments" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Loans for investments" slightly decreases the Element "Asset price".

The initial impulse of decreasing the Element "Loans for investments" slightly increases the Element "Asset price".

Paths from Element 16 (Loans for investments) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Loans for investments" leads to an increase of the Element "Liquidity of banks" in 60 cases. In 66 cases the initial impulse of an increase of the Element "Loans for investments" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Loans for investments" leads to a decrease of the Element "Liquidity of banks" in 60 cases. In 66 cases the initial impulse of a decrease of the Element "Loans for investments" leads to an increase of the Element "Liquidity of banks".

4.8% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 16.9 for positive paths and 16.4 for negative paths. The median is 18.0 for positive paths and 17.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-164 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

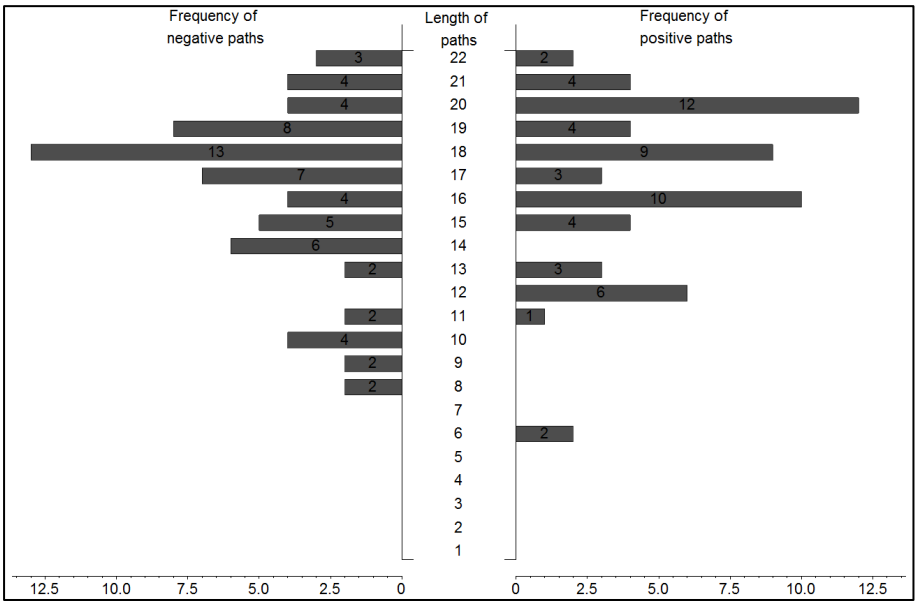


Figure 5-164: Length of paths from Element 16 to Element 19 (from Element "Loans for investments" to Element "Liquidity of banks")

The Element “Creditworthiness of financed investors” is directly related and, therefore, more often involved in paths from Element 16 to Element 19. Indirectly, the Elements “Costs of new loans”, “Attractiveness of financed investments”, “New loans for investments”, “Risk of debt default” and “Asset cash flow” play significant roles. Elements are equally involved in positive and negative paths. Figure 5-165 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

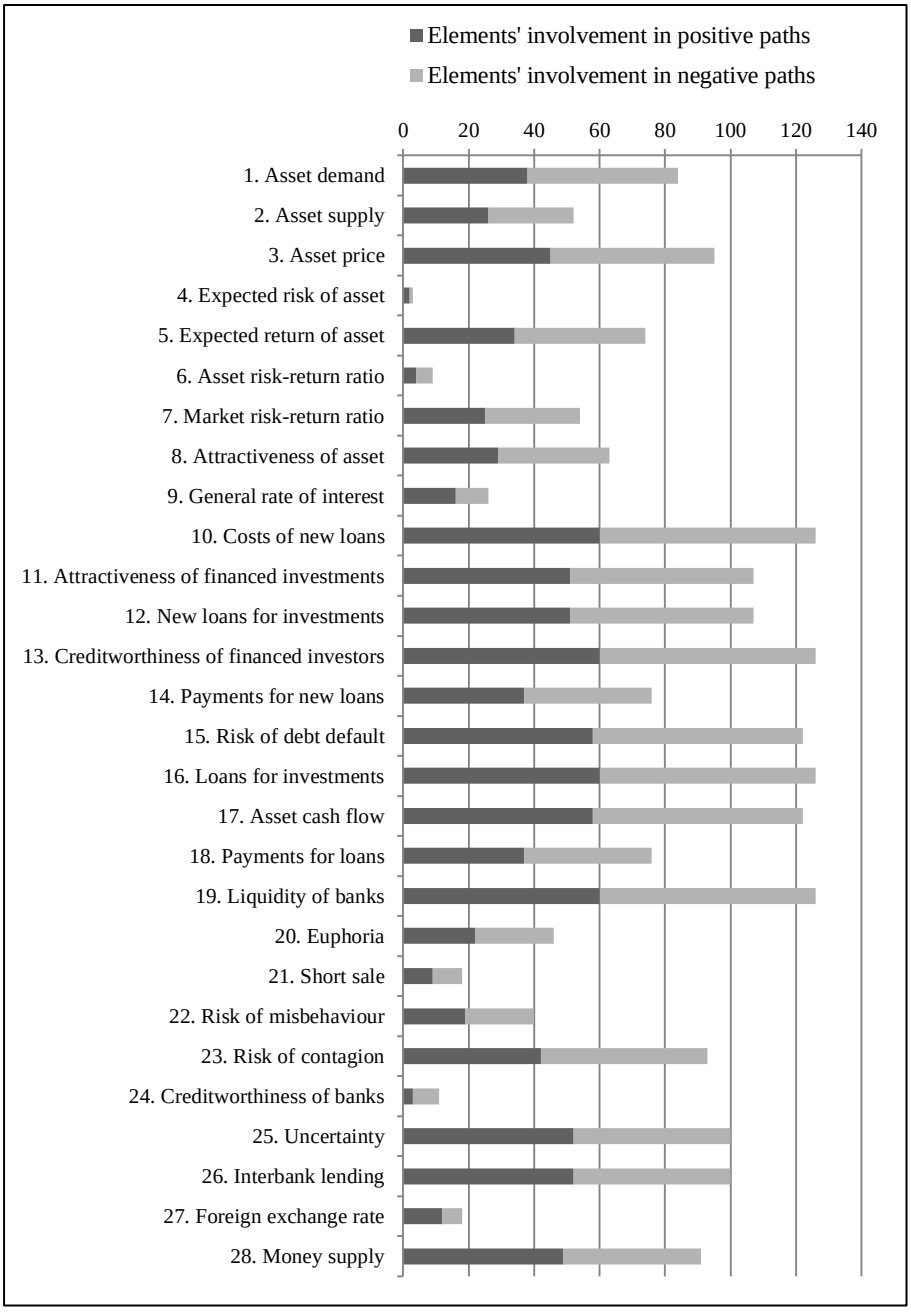


Figure 5-165: Involvement of elements in paths from Element 16 to Element 19 (from Element "Loans for investments" to Element "Liquidity of banks"

Interpretation: The initial impulse of increasing the Element "Loans for investments" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Loans for investments" slightly increases the Element "Liquidity of banks".

Paths from Element 16 (Loans for investments) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Loans for investments" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 36 cases the initial impulse of an increase of the Element "Loans for investments" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Loans for investments" leads to a decrease of the Element "Foreign exchange rate" in 44 cases. In 36 cases the initial impulse of a decrease of the Element "Loans for investments" leads to an increase of the Element "Foreign exchange rate".

10.0% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 19.4 for positive paths and 19.2 for negative paths. The median is 20.5 for positive paths and 19.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-166 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

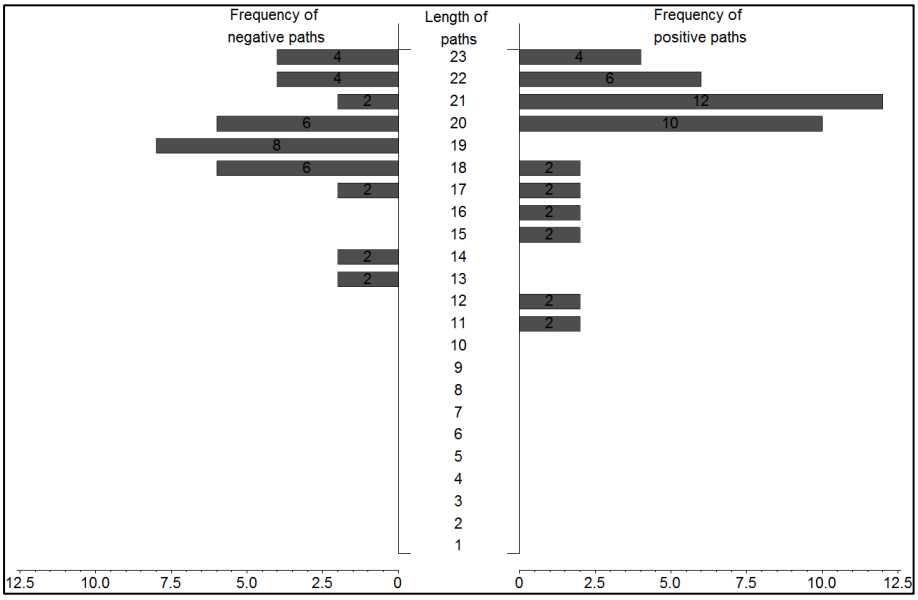


Figure 5-166: Length of paths from Element 16 to Element 27 (from Element "Loans for investments" to Element "Foreign exchange rate")

The Element “Creditworthiness of financed investors” is directly related and, therefore, more often involved in paths from Element 16 to Element 27. Indirectly, the Elements “Asset price”, “Expected return of asset”, “Costs of new loans”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Asset demand”, “Asset price”, “Expected return of asset”, “Market risk-return ratio”, “Attractiveness of asset”, “Attractiveness of financed investments“, “Euphoria”, “Risk of misbehaviour”, “Risk of contagion” and “Creditworthiness of banks” are more often involved in positive paths. Figure 5-167 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

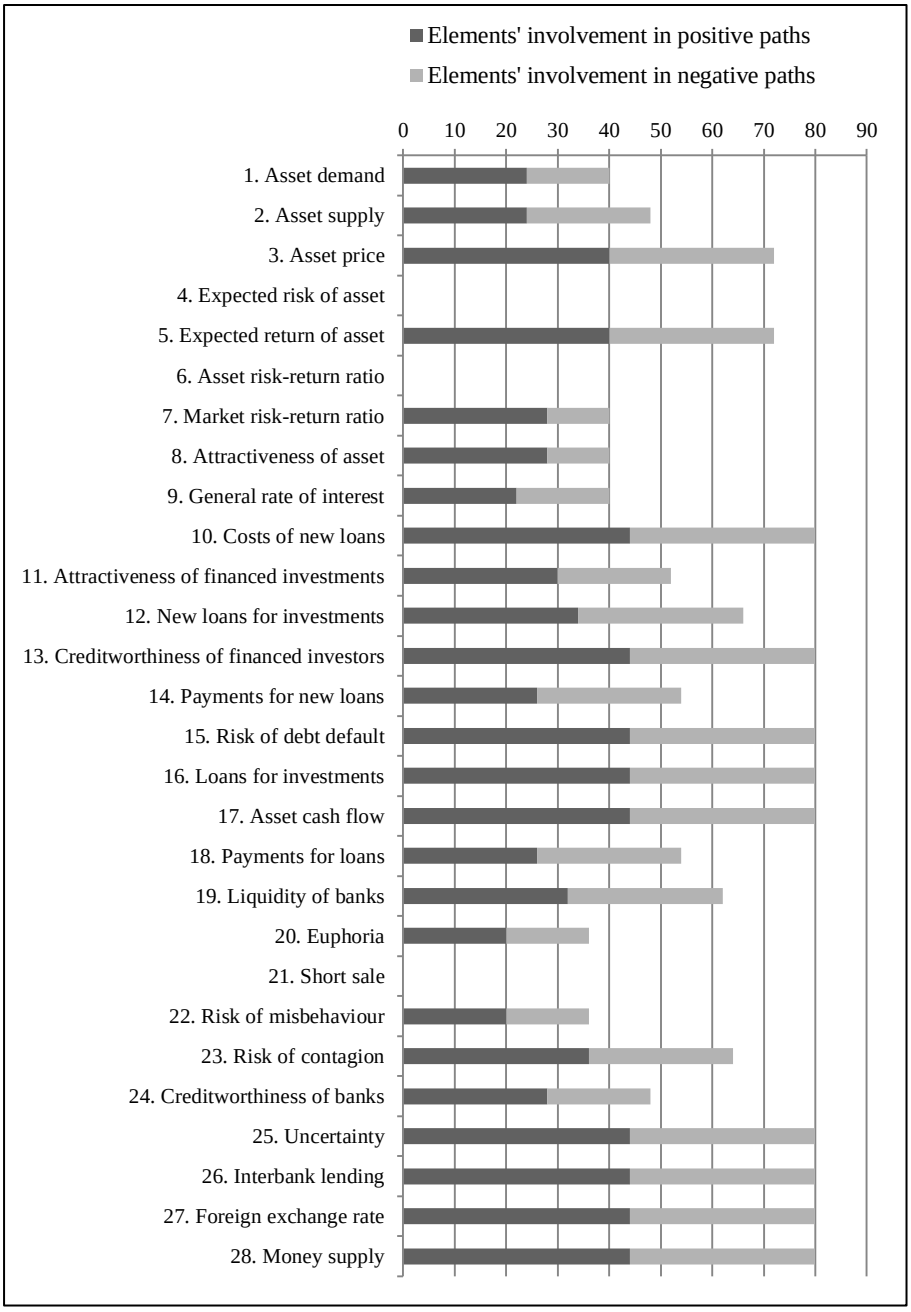


Figure 5-167: Involvement of elements in paths from Element 16 to Element 27 (from Element "Loans for investments" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Loans for investments" increases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Loans for investments" decreases the Element "Foreign exchange rate".

Paths from Element 20 (Euphoria) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Euphoria" leads to an increase of the Element "Asset price" in 101 cases. In 93 cases the initial impulse of an increase of the Element "Euphoria" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Euphoria" leads to a decrease of the Element "Asset price" in 101 cases. In 93 cases the initial impulse of a decrease of the Element "Euphoria" leads to an increase of the Element "Asset price".

4.1% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 14.5 for positive paths and 14.9 for negative paths. The median is 15.0 for both. The spread of the lengths of negative paths is greater. Figure 5-168 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

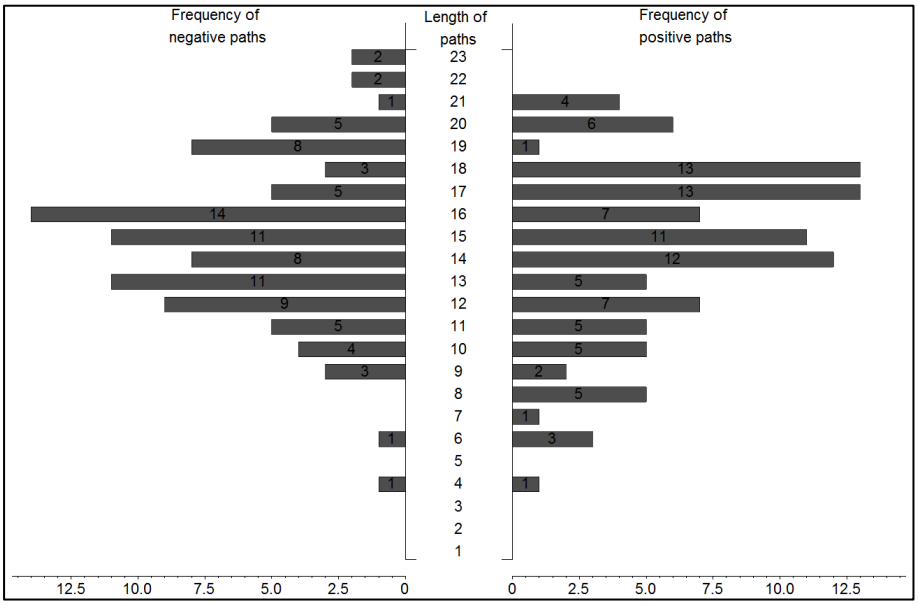


Figure 5-168: Length of paths from Element 20 to Element 3 (from Element "Euphoria" to Element "Asset price")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in paths from

Element 20 to Element 3. Indirectly, the Elements "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-169 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

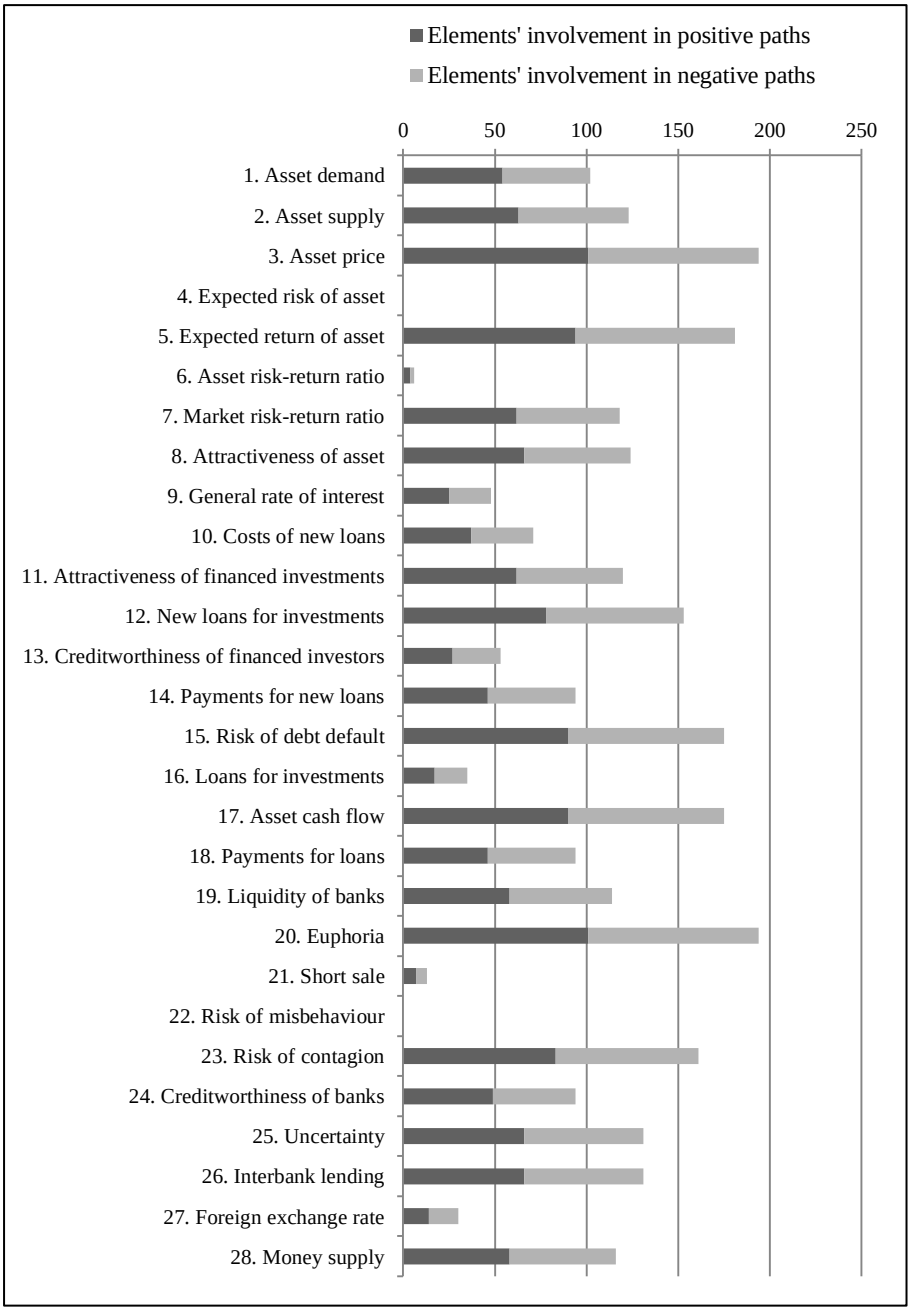


Figure 5-169: Involvement of elements in paths from Element 20 to Element 3 (from Element "Euphoria" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Euphoria" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Euphoria" slightly decreases the Element "Asset price".

Paths from Element 20 (Euphoria) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Euphoria" leads to an increase of the Element "Liquidity of banks" in 227 cases. In 221 cases the initial impulse of an increase of the Element "Euphoria" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Euphoria" leads to a decrease of the Element "Liquidity of banks" in 227 cases. In 221 cases the initial impulse of a decrease of the Element "Euphoria" leads to an increase of the Element "Liquidity of banks".

1.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.7 for positive paths and 15.8 for negative paths. The median is 16.0 for both. The spreads of the lengths of positive paths and negative paths are identical. Figure 5-170 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

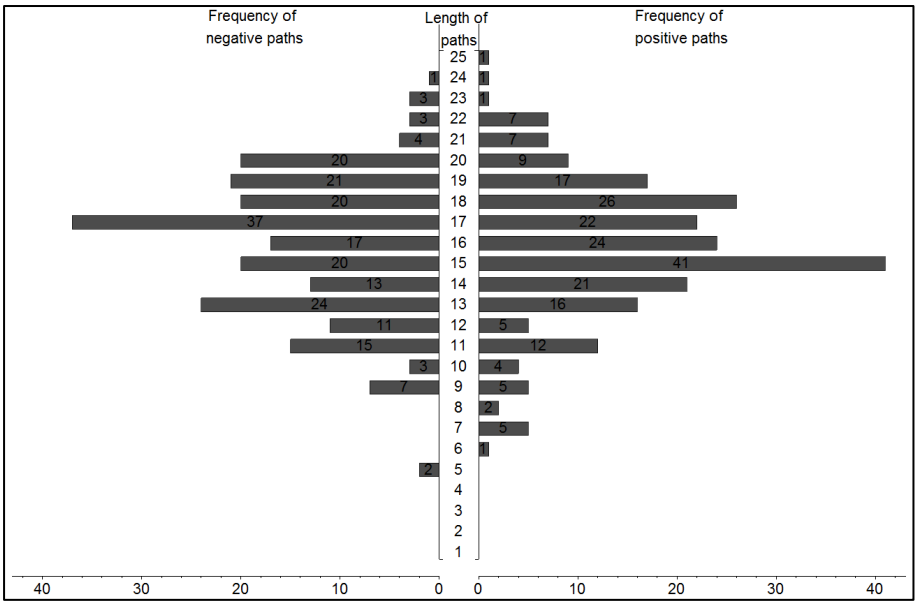


Figure 5-170: Length of paths from Element 20 to Element 19 (from Element "Euphoria" to Element "Liquidity of banks")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in paths from Element 16 to Element 19. Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles. In general, elements are equally involved in positive and negative paths. However, there is one significant exception. The Element "Creditworthiness of banks" is more often involved in positive paths. Figure 5-171 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

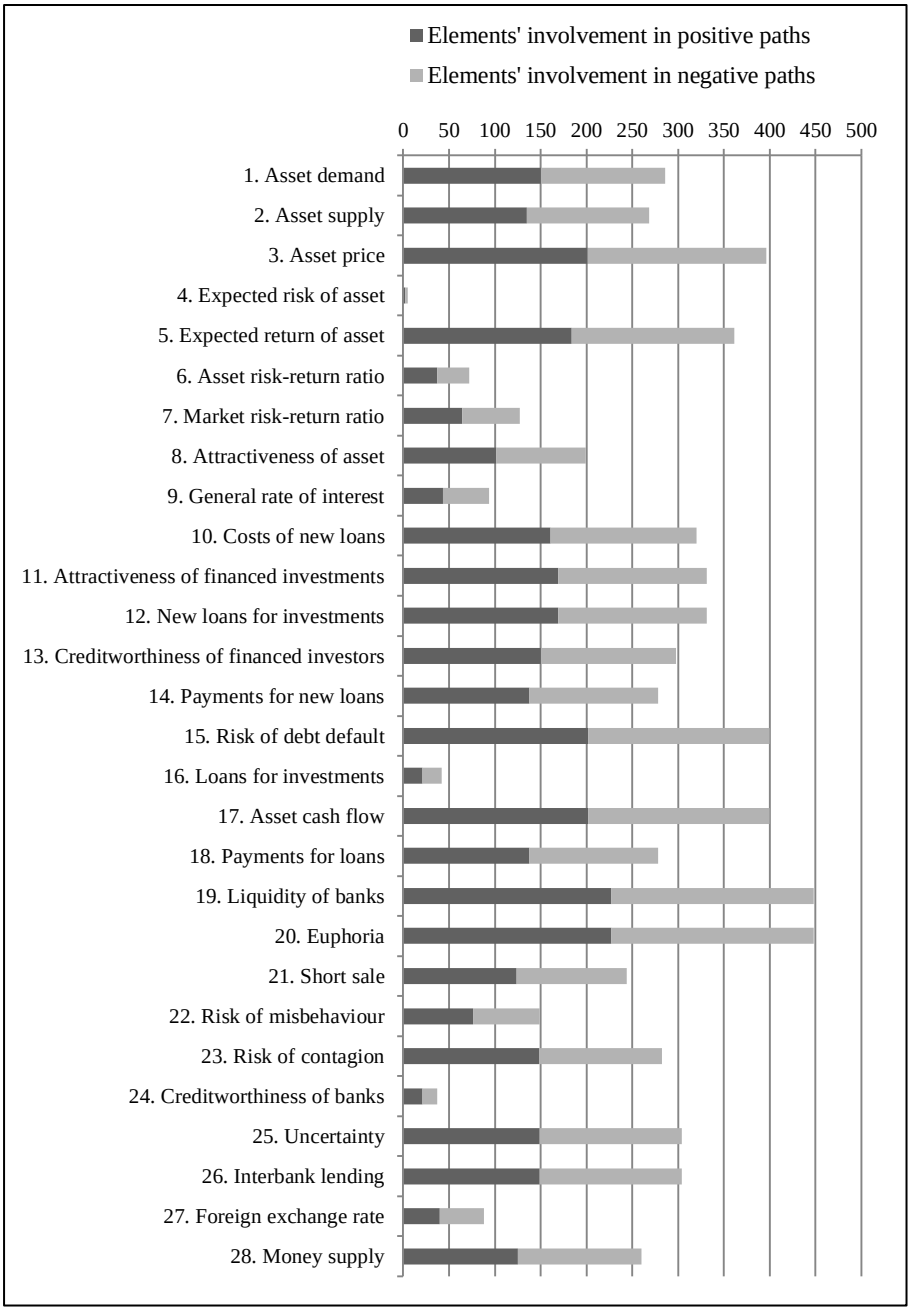


Figure 5-171: Involvement of elements in paths from Element 20 to Element 19 (from Element "Euphoria" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Euphoria" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Euphoria" slightly decreases the Element "Liquidity of banks".

Paths from Element 20 (Euphoria) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Euphoria" leads to an increase of the Element "Foreign exchange rate" in 68 cases. In 70 cases the initial impulse of an increase of the Element "Euphoria" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Euphoria" leads to a decrease of the Element "Foreign exchange rate" in 68 cases. In 70 cases the initial impulse of a decrease of the Element "Euphoria" leads to an increase of the Element "Foreign exchange rate".

1.4% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 17.9 for positive paths and 17.2 for negative paths. The median is 18.0 for positive paths and 17.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-172 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

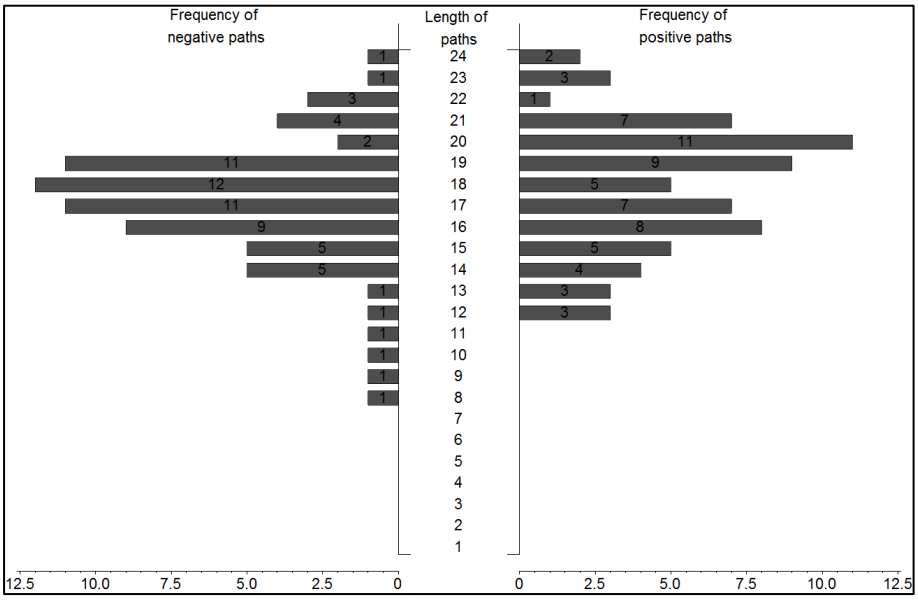


Figure 5-172: Length of paths from Element 20 to Element 27 (from Element "Euphoria" to Element "Foreign exchange rate")

Indirectly, the Elements "Asset price", "New loans for investments", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank

lending" and "Money supply" play significant roles in paths from Element 20 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Payments for new loans", "Payments for loans" and "Liquidity of banks" are more often involved in positive paths. Figure 5-173 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

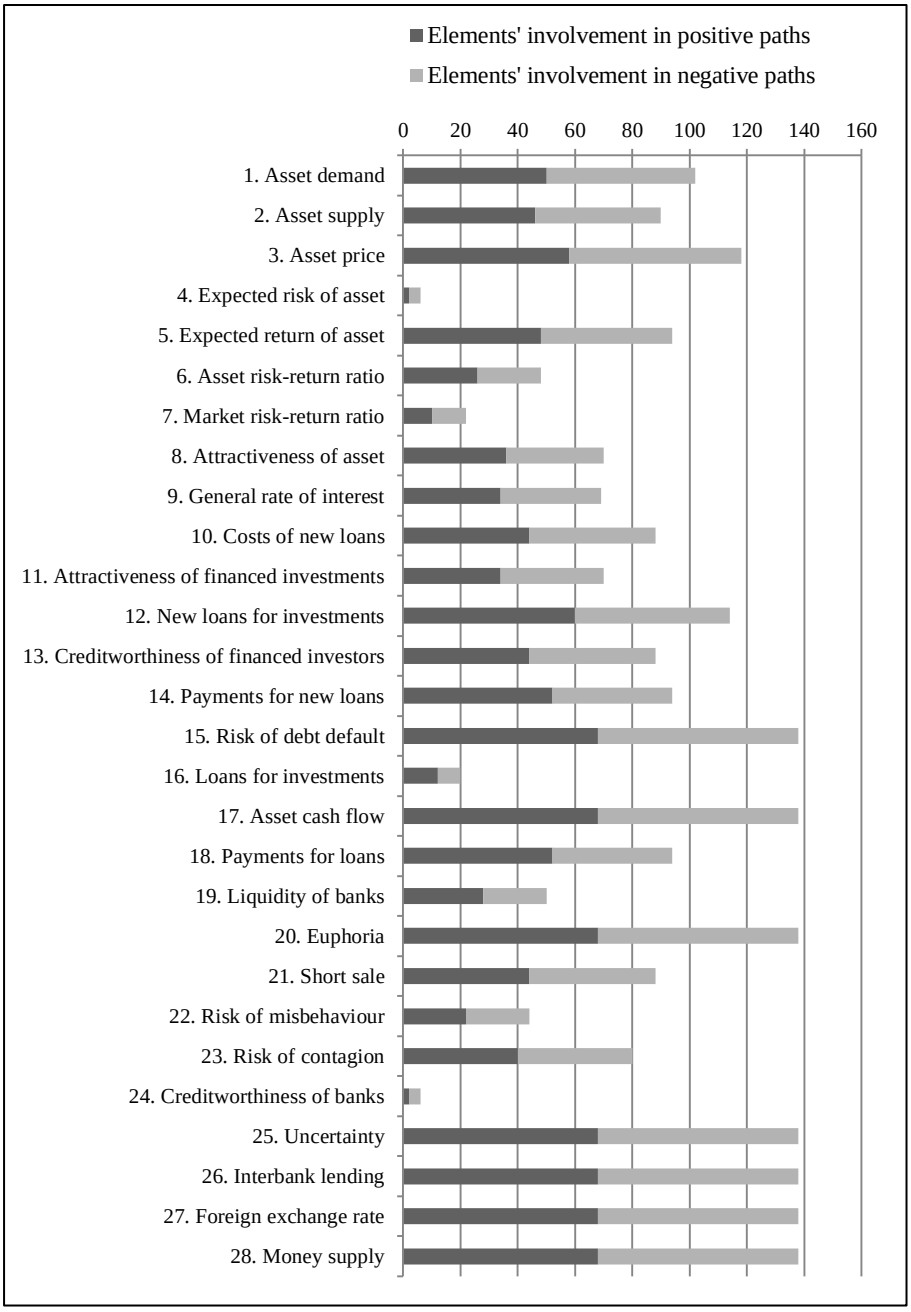


Figure 5-173: Involvement of elements in paths from Element 20 to Element 27 (from Element "Euphoria" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Euphoria" slightly decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Euphoria" slightly increases the Element "Foreign exchange rate".

Paths from Element 22 (Risk of misbehaviour) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Risk of misbehaviour" leads to an increase of the Element "Asset price" in 96 cases. In 91 cases the initial impulse of an increase of the Element "Risk of misbehaviour" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Risk of misbehaviour" leads to a decrease of the Element "Asset price" in 96 cases. In 91 cases the initial impulse of a decrease of the Element "Risk of misbehaviour" leads to an increase of the Element "Asset price".

2.7% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 14.6 for positive paths and 14.8 for negative paths. The median is 15.0 for both. The spread of the lengths of negative paths is greater. Figure 5-174 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

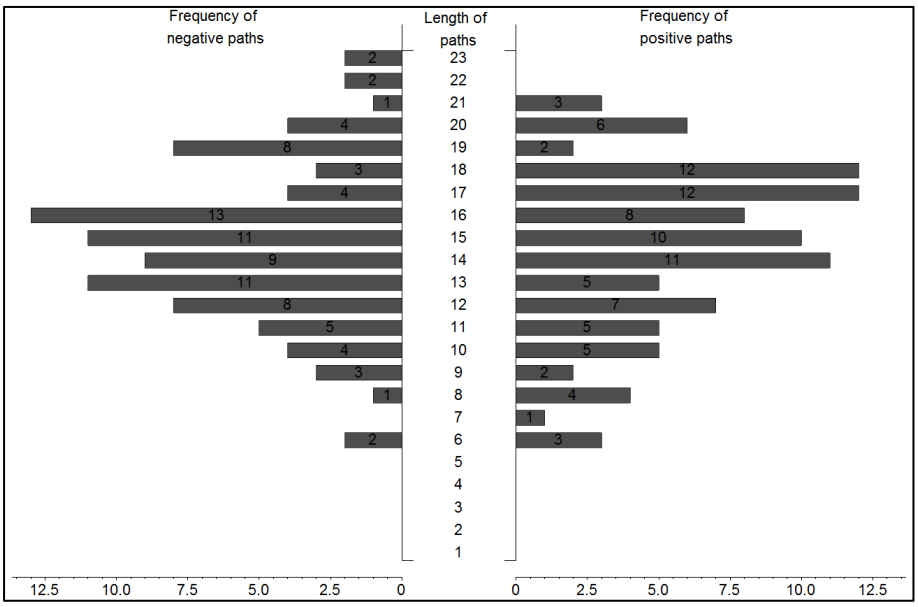


Figure 5-174: Length of paths from Element 22 to Element 3 (from Element "Risk of misbehaviour" to Element "Asset price")

Next to other elements, the Element "Expected return of asset" is

directly related and, therefore, more often involved in paths from Element 22 to Element 3. Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-175 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

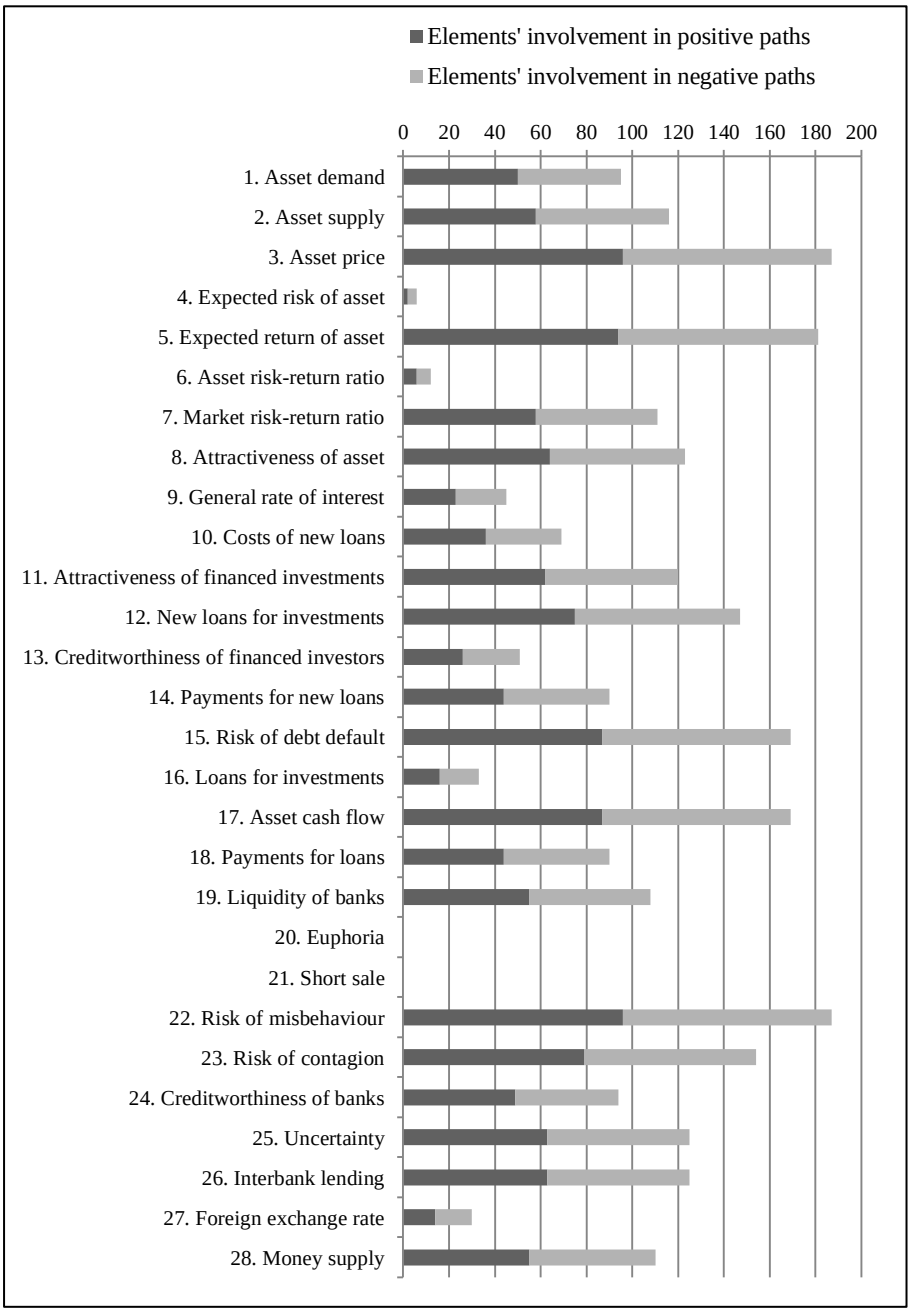


Figure 5-175: Involvement of elements in paths from Element 22 to Element 3 (from Element "Risk of misbehaviour" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Risk of misbehaviour" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Risk of misbehaviour" slightly decreases the Element "Asset price".

Paths from Element 22 (Risk of misbehaviour) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Risk of misbehaviour" leads to an increase of the Element "Liquidity of banks" in 204 cases. In 197 cases the initial impulse of an increase of the Element "Risk of misbehaviour" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Risk of misbehaviour" leads to a decrease of the Element "Liquidity of banks" in 204 cases. In 197 cases the initial impulse of a decrease of the Element "Risk of misbehaviour" leads to an increase of the Element "Liquidity of banks".

1.7% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 16.2 for both. The median is 17.0 for both. The spread of the lengths of negative paths is greater. Figure 5-176 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

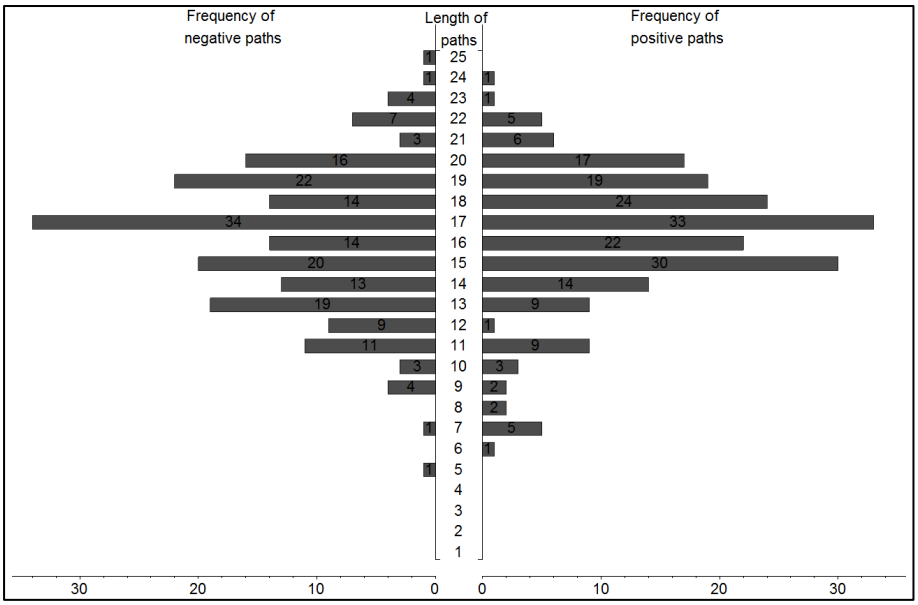


Figure 5-176: Length of paths from Element 22 to Element 19 (from Element "Risk of misbehaviour" to Element "Liquidity of banks")

Next to other elements, the Element "Expected return of asset" is directly related and, therefore, more often involved in paths from Element 22 to Element 19. Indirectly, the Elements "Asset price", "Attractiveness of asset", "Risk of debt default" and "Asset cash flow" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-177 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

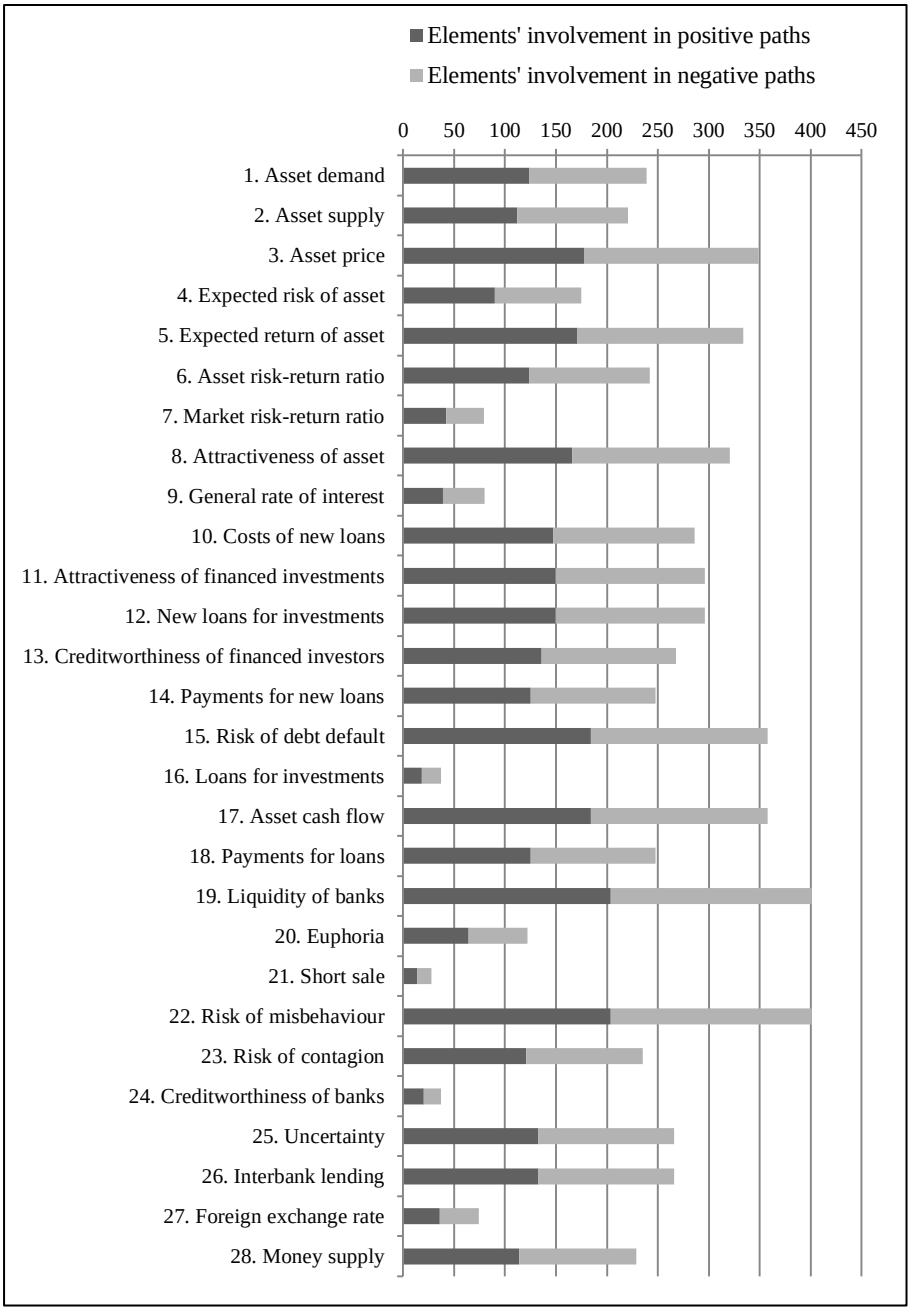


Figure 5-177: Involvement of elements in paths from Element 22 to Element 19 (from Element "Risk of misbehaviour" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Risk of misbehaviour" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Risk of misbehaviour" slightly decreases the Element "Liquidity of banks".

Paths from Element 22 (Risk of misbehaviour) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Risk of misbehaviour" leads to an increase of the Element "Foreign exchange rate" in 62 cases. In 66 cases the initial impulse of an increase of the Element "Risk of misbehaviour" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Risk of misbehaviour" leads to a decrease of the Element "Foreign exchange rate" in 62 cases. In 66 cases the initial impulse of a decrease of the Element "Risk of misbehaviour" leads to an increase of the Element "Foreign exchange rate".

3.1% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 17.9 for positive paths and 18.5 for negative paths. The median is 18.0 for positive paths and 19.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-178 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

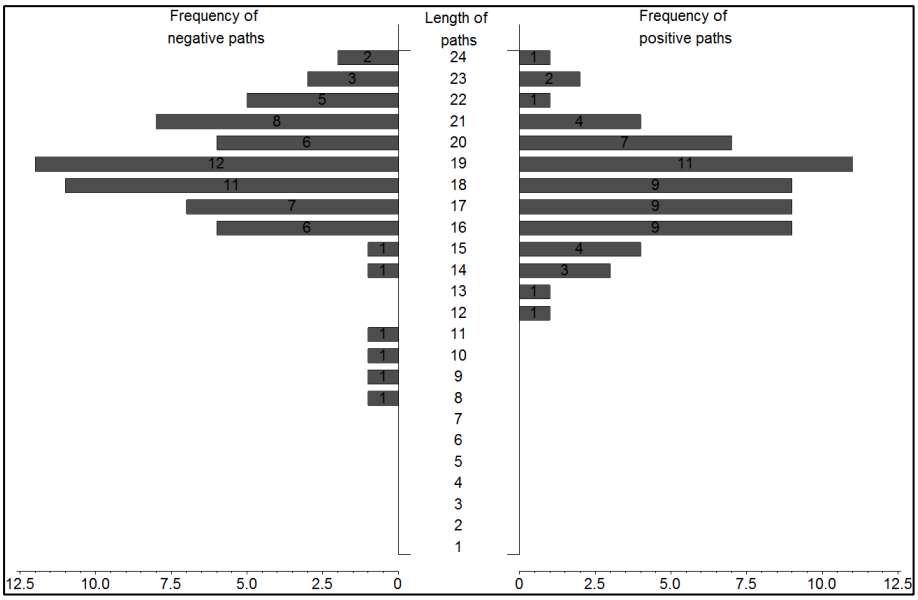


Figure 5-178: Length of paths from Element 22 to Element 27 (from Element "Risk of misbehaviour" to Element "Foreign exchange rate")

Indirectly, the Elements “Asset price”, “Asset risk-return ratio”, Attractiveness of asset”, “New loans for investments”, “Risk of debt default”, “Asset cash flow”, “Uncertainty”, “Interbank lending” and “Money supply” play significant roles in paths from Element 22 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements “Attractiveness of financed investments“, “Payments for new loans” and “Payments for loans” are more often involved in negative paths. Figure 5-179 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

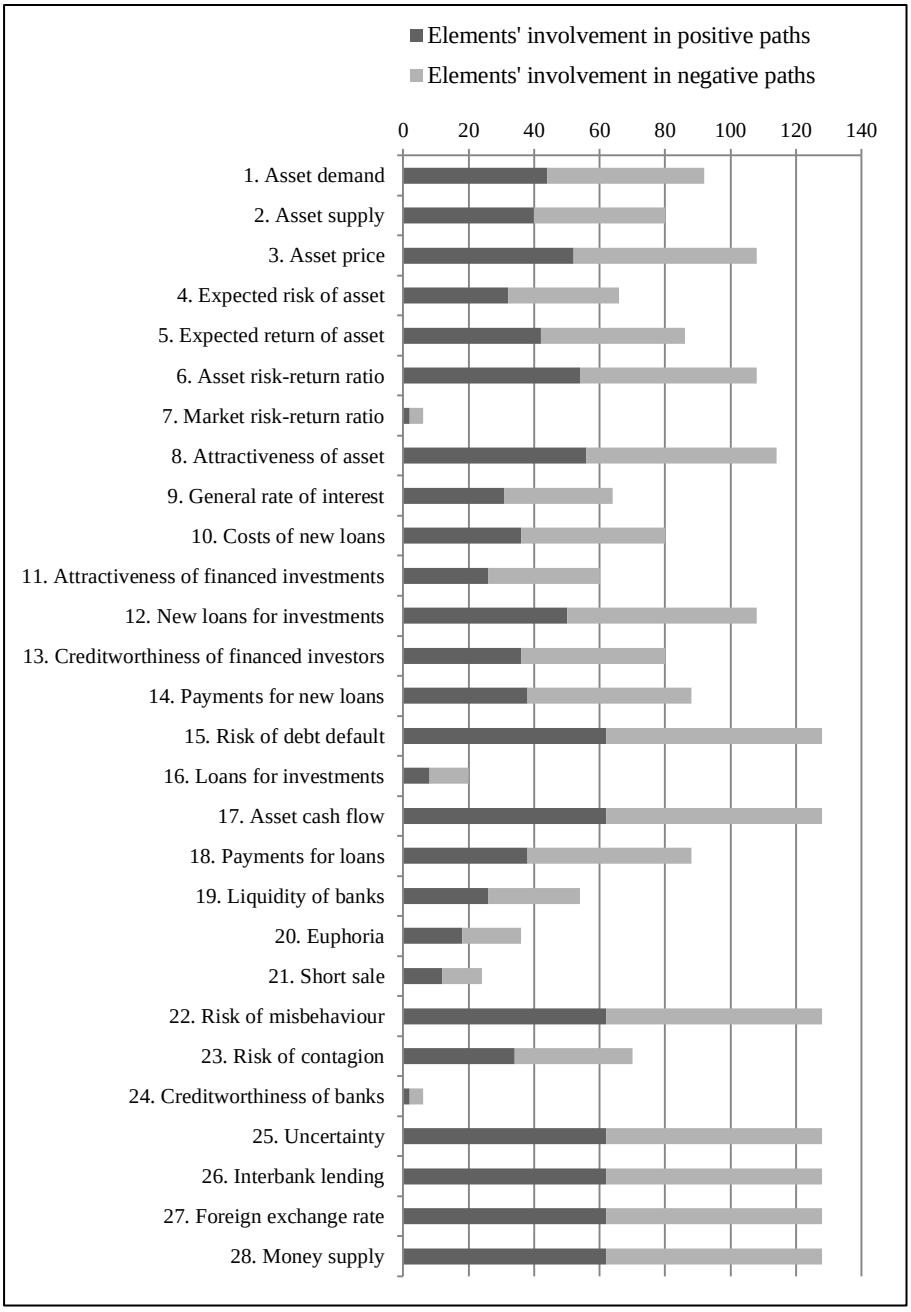


Figure 5-179: Involvement of elements in paths from Element 22 to Element 27 (from Element "Risk of misbehaviour" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Risk of misbehaviour" slightly decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Risk of misbehaviour" slightly increases the Element "Foreign exchange rate".

Paths from Element 23 (Risk of contagion) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Risk of contagion" leads to an increase of the Element "Asset price" in 10 cases. In 9 cases the initial impulse of an increase of the Element "Risk of contagion" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Risk of contagion" leads to a decrease of the Element "Asset price" in 10 cases. In 9 cases the initial impulse of a decrease of the Element "Risk of contagion" leads to an increase of the Element "Asset price".

5.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 12.5 for positive paths and 11.7 for negative paths. The median is 13.0 for both. The spreads of positive paths and negative paths are similar. For a detailed list of numbers please refer to Appendix 5.

Next to other elements, the Element "Liquidity of banks" is directly related and, therefore, more often involved in paths from Element 23 to Element 3. Indirectly, the Elements "New loans for investments", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-180 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

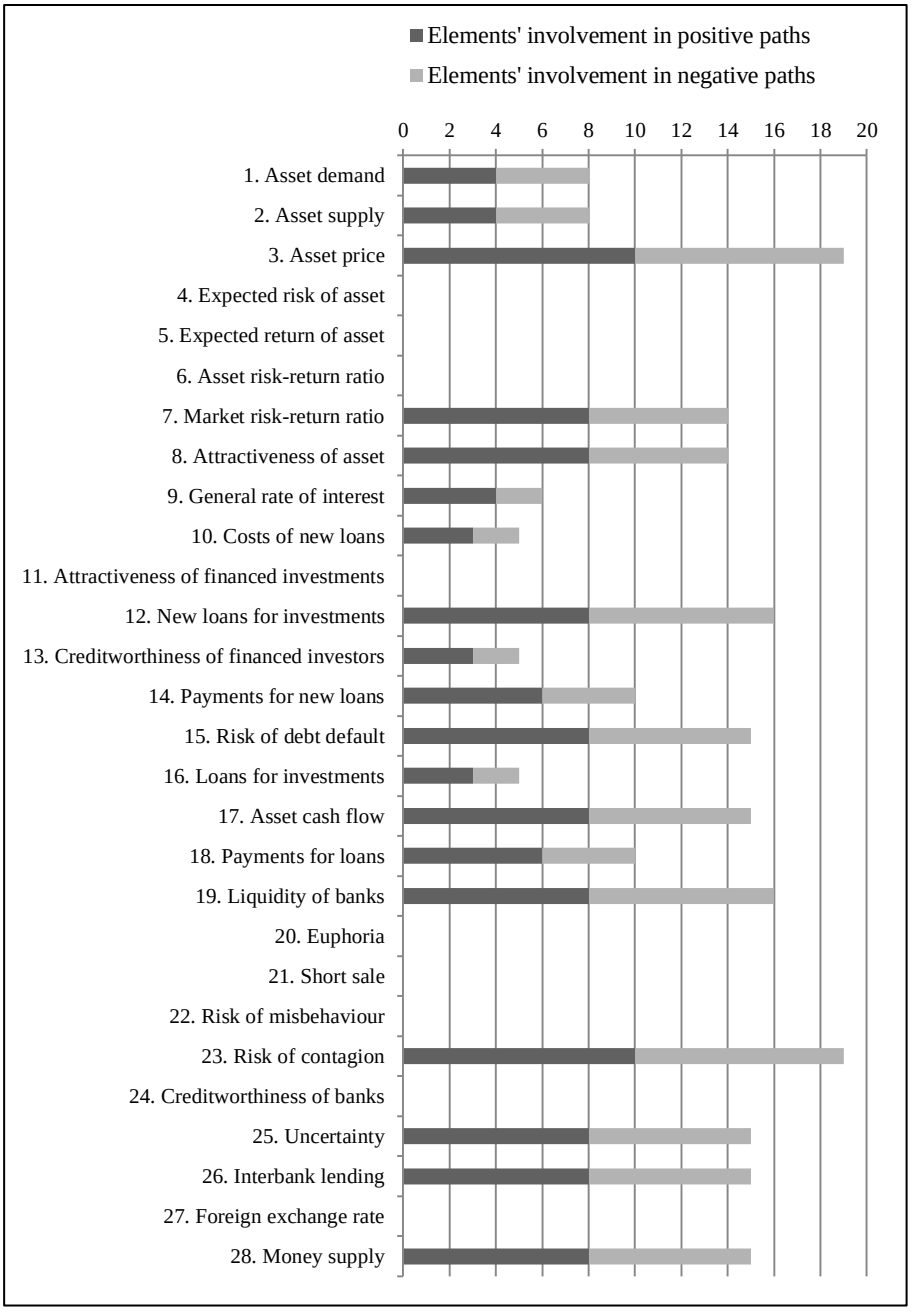


Figure 5-180: Involvement of elements in paths from Element 23 to Element 3 (from Element "Risk of contagion" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Risk of contagion" increases the Element "Asset price".

The initial impulse of decreasing the Element "Risk of contagion" decreases the Element "Asset price".

Paths from Element 23 (Risk of contagion) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Risk of contagion" leads to an increase of the Element "Liquidity of banks" in 100 cases. In 108 cases the initial impulse of an increase of the Element "Risk of contagion" leads to a decrease of the Element "Liquidity of banks".
The initial impulse of a decrease of the Element "Risk of contagion" leads to a decrease of the Element "Liquidity of banks" in 100 cases. In 108 cases the initial impulse of a decrease of the Element "Risk of contagion" leads to an increase of the Element "Liquidity of banks".
3.8% more negative paths exist compared to positive paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 15.2 for both. The median is 15.0 for positive paths and 16.0 for negative paths. The spread of the lengths of negative paths is greater. Figure 5-181 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

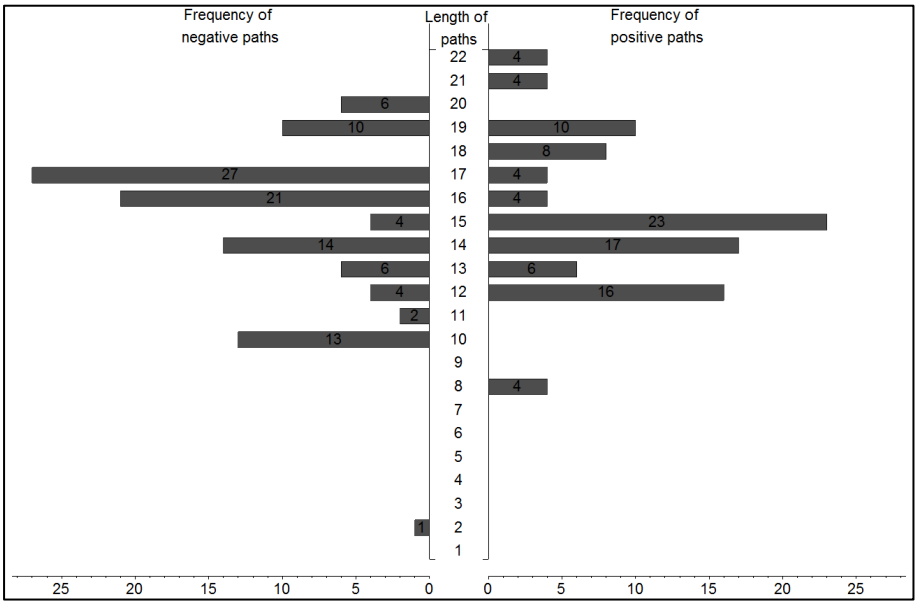


Figure 5-181: Length of paths from Element 23 to Element 19 (from Element "Risk of contagion" to Element "Liquidity of banks")

Indirectly, the Elements "Asset price", "Risk of debt default" and "Asset cash flow" play significant roles in paths from Element 23 to

Element 19. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "Asset demand", "Market risk-return ratio" and "Attractiveness of asset" are more often involved in negative paths. Figure 5-182 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

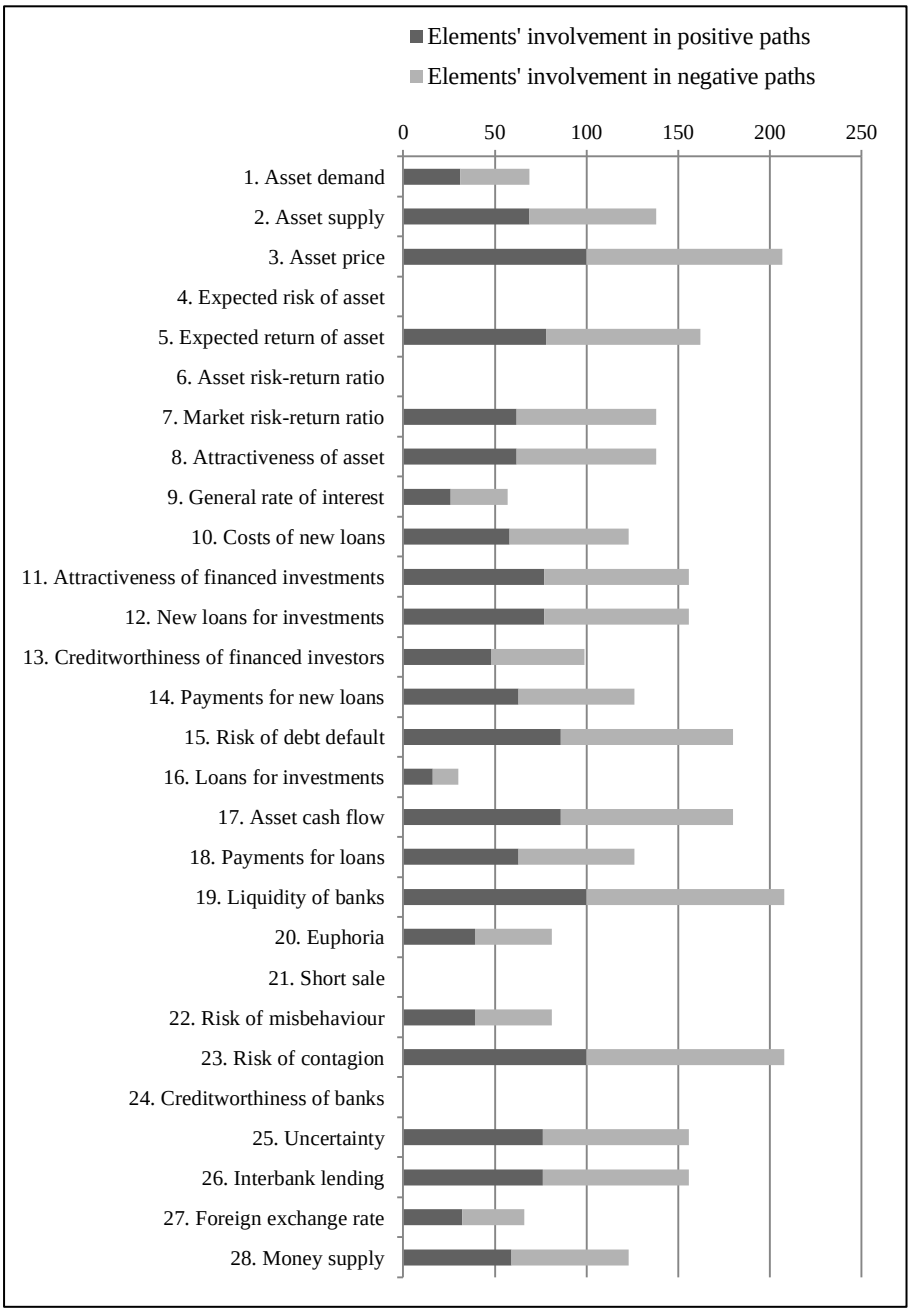


Figure 5-182: Involvement of elements in paths from Element 23 to Element 19 (from Element "Risk of contagion" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Risk of contagion" slightly decreases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Risk of contagion" slightly increases the Element "Liquidity of banks".

Paths from Element 23 (Risk of contagion) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Risk of contagion" leads to an increase of the Element "Foreign exchange rate" in 44 cases. In 40 cases the initial impulse of an increase of the Element "Risk of contagion" leads to a decrease of the Element "Foreign exchange rate".

The initial impulse of a decrease of the Element "Risk of contagion" leads to a decrease of the Element "Foreign exchange rate" in 44 cases. In 40 cases the initial impulse of a decrease of the Element "Risk of contagion" leads to an increase of the Element "Foreign exchange rate".

4.8% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. Shorter positive paths are equalised by longer positive paths. The mean is 16.0 for positive paths and 15.2 for negative paths. The median is 17.0 for positive paths and 15.0 for negative paths. The spread of the lengths of positive paths is greater. Figure 5-183 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

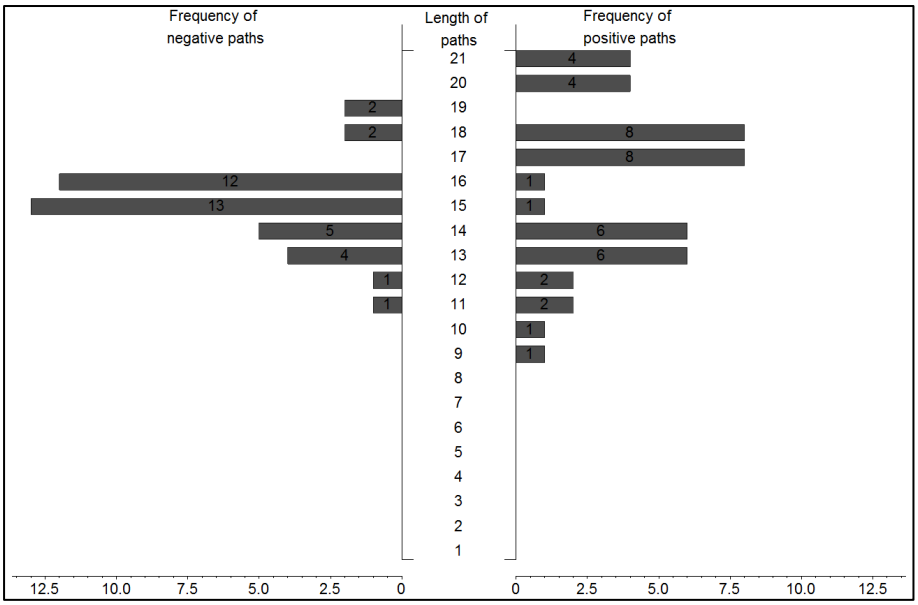


Figure 5-183: Length of paths from Element 23 to Element 27 (from Element "Risk of contagion" to Element "Foreign exchange rate")

Indirectly, the Elements "Asset price", "Risk of debt default", "Asset cash flow", "Uncertainty", "Interbank lending" and "Money supply" play significant roles in paths from Element 23 to Element 27. In general, elements are equally involved in positive and negative paths. However, there are several significant exceptions. The Elements "New loans for investments", "Payments for new loans" and "Payments for loans" are more often involved in positive paths. Figure 5-184 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

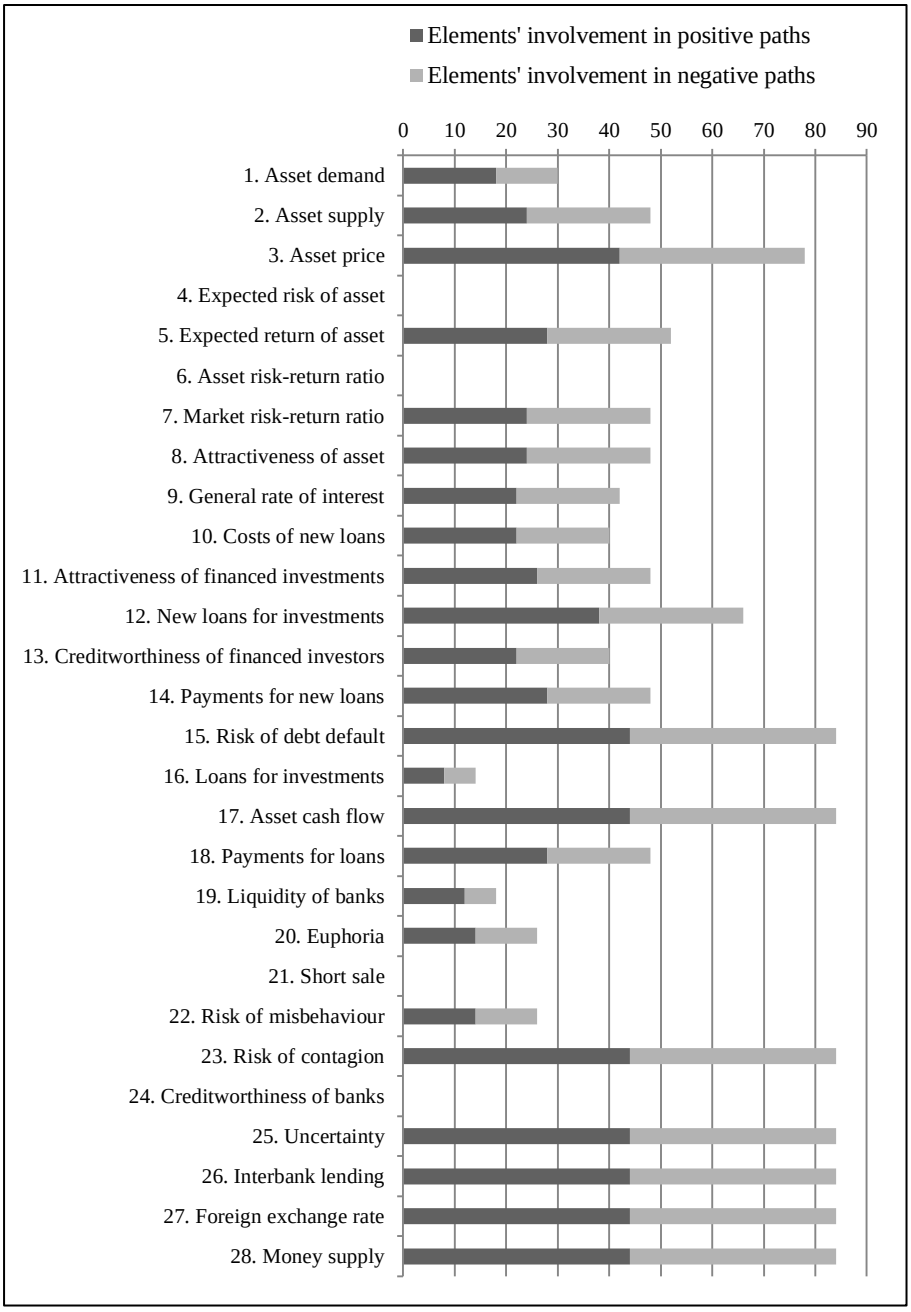


Figure 5-184: Involvement of elements in paths from Element 23 to Element 27 (from Element "Risk of contagion" to Element "Foreign exchange rate")

Interpretation: The initial impulse of increasing the Element "Risk of contagion" slightly increases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Risk of contagion" slightly decreases the Element "Foreign exchange rate".

Paths from Element 26 (Interbank lending) to Element 3 (Asset price)

Results: The initial impulse of an increase of the Element "Interbank lending" leads to an increase of the Element "Asset price" in 76 cases. In 72 cases the initial impulse of an increase of the Element "Interbank lending" leads to a decrease of the Element "Asset price".

The initial impulse of a decrease of the Element "Interbank lending" leads to a decrease of the Element "Asset price" in 76 cases. In 72 cases the initial impulse of a decrease of the Element "Interbank lending" leads to an increase of the Element "Asset price".

2.7% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive paths and negative paths are similar. The mean is 12.2 for both. The median is 13.0 for positive paths and 12.0 for negative paths. The spreads of the lengths of positive paths and negative paths are identical. Figure 5-185 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

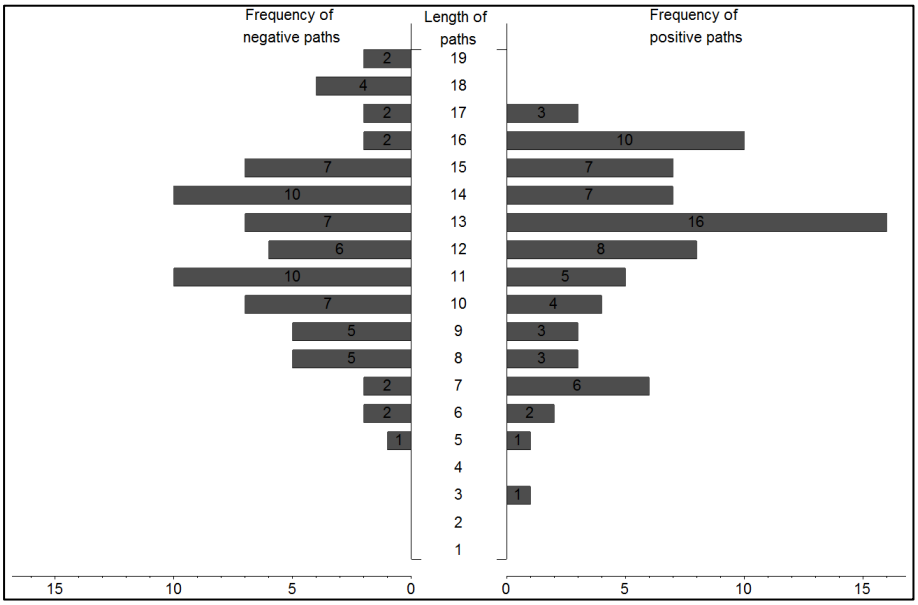


Figure 5-185: Length of paths from Element 26 to Element 3 (from Element "Interbank lending" to Element "Asset price")

The Elements "Liquidity of banks" and "Money supply" are directly related and, therefore, more often involved in paths from Element 26 to

Element 3. Indirectly, the Elements "New loans for investments" and "Risk of contagion" play significant roles. Elements are equally involved in positive and negative paths. Figure 5-186 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

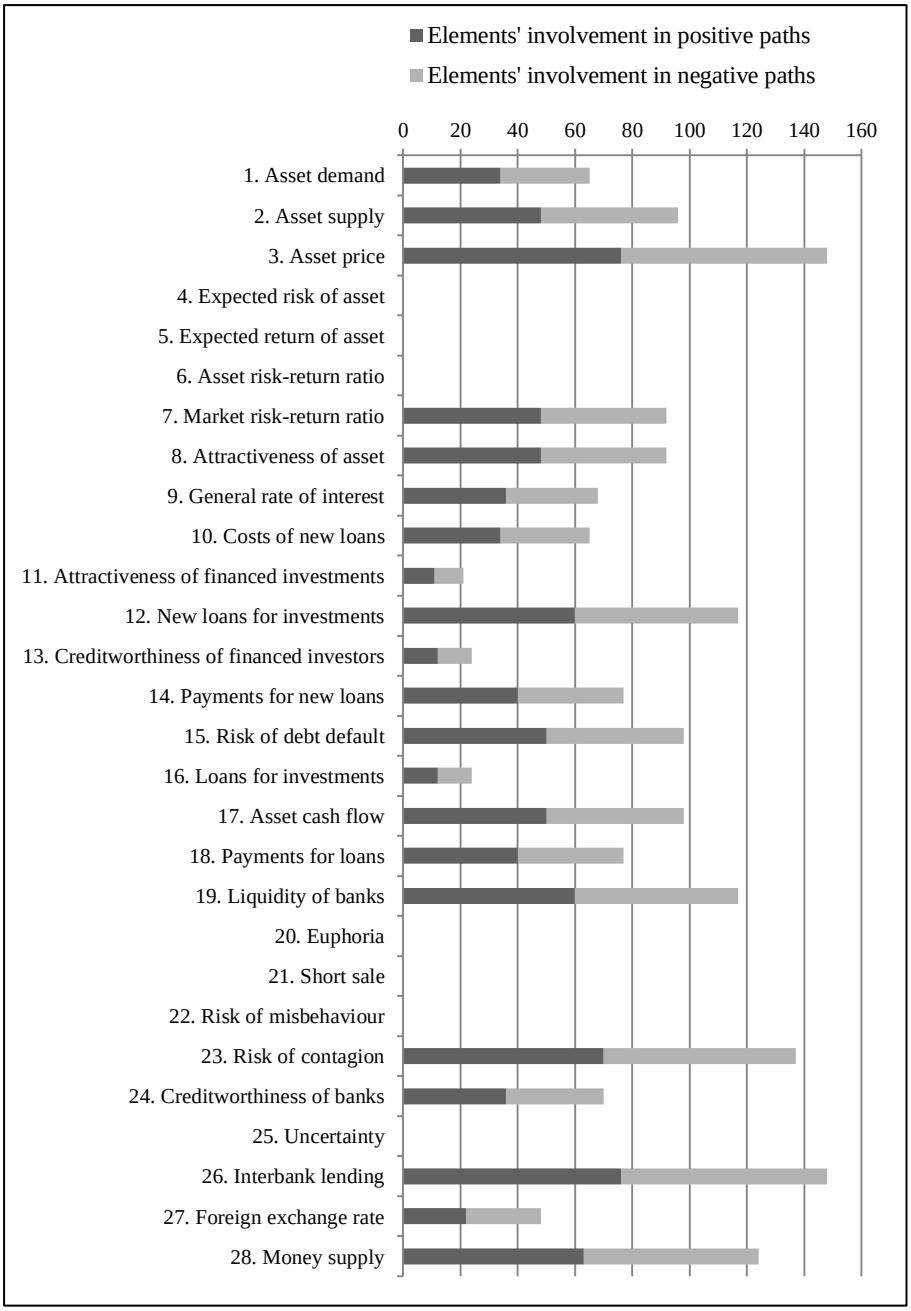


Figure 5-186: Involvement of elements in paths from Element 26 to Element 3 (from Element "Interbank lending" to Element "Asset price")

Interpretation: The initial impulse of increasing the Element "Interbank lending" slightly increases the Element "Asset price".

The initial impulse of decreasing the Element "Interbank lending" slightly decreases the Element "Asset price".

Paths from Element 26 (Interbank lending) to Element 19 (Liquidity of banks)

Results: The initial impulse of an increase of the Element "Interbank lending" leads to an increase of the Element "Liquidity of banks" in 174 cases. In 163 cases the initial impulse of an increase of the Element "Interbank lending" leads to a decrease of the Element "Liquidity of banks".

The initial impulse of a decrease of the Element "Interbank lending" leads to a decrease of the Element "Liquidity of banks" in 174 cases. In 163 cases the initial impulse of a decrease of the Element "Interbank lending" leads to an increase of the Element "Liquidity of banks".

3.3% more positive paths exist compared to negative paths. For a detailed list of paths please refer to Appendix 4.

The lengths of positive and negative paths are similar. The mean is 14.5 for positive paths and 14.6 for negative paths. The median is 15.0 for both. The spreads of the lengths of positive paths and negative paths are similar. Figure 5-187 shows the respective histograms. For a detailed list of numbers please refer to Appendix 5.

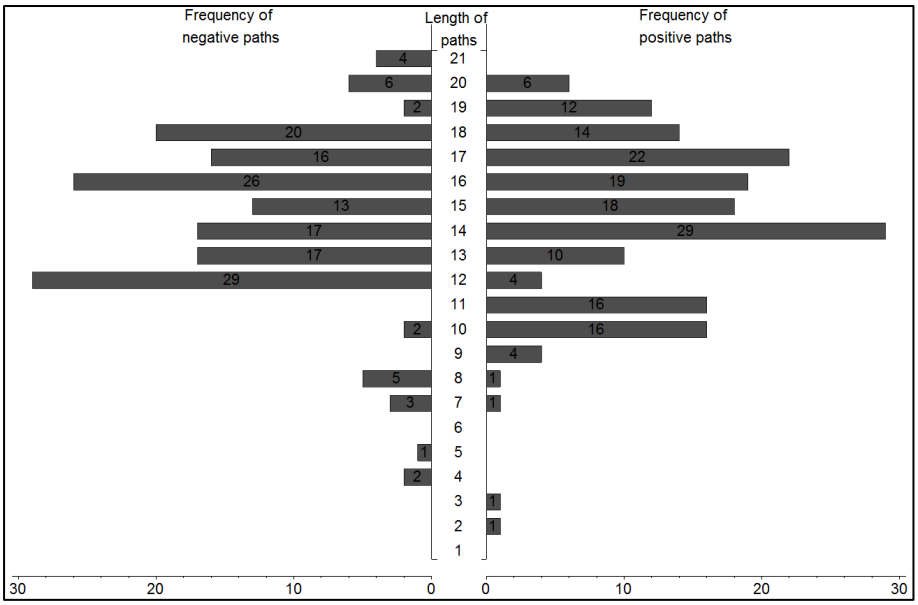


Figure 5-187: Length of paths from Element 26 to Element 19 (from Element "Interbank lending" to Element "Liquidity of banks")

Next to other elements, the Element "Money supply" is directly related and, therefore, more often involved in paths from Element 26 to Element 19. Indirectly, the Element "Asset price" plays a significant role. Elements are equally involved in positive and negative paths. Figure 5-188 shows the respective distribution. For a detailed list of numbers please refer to Appendix 6.

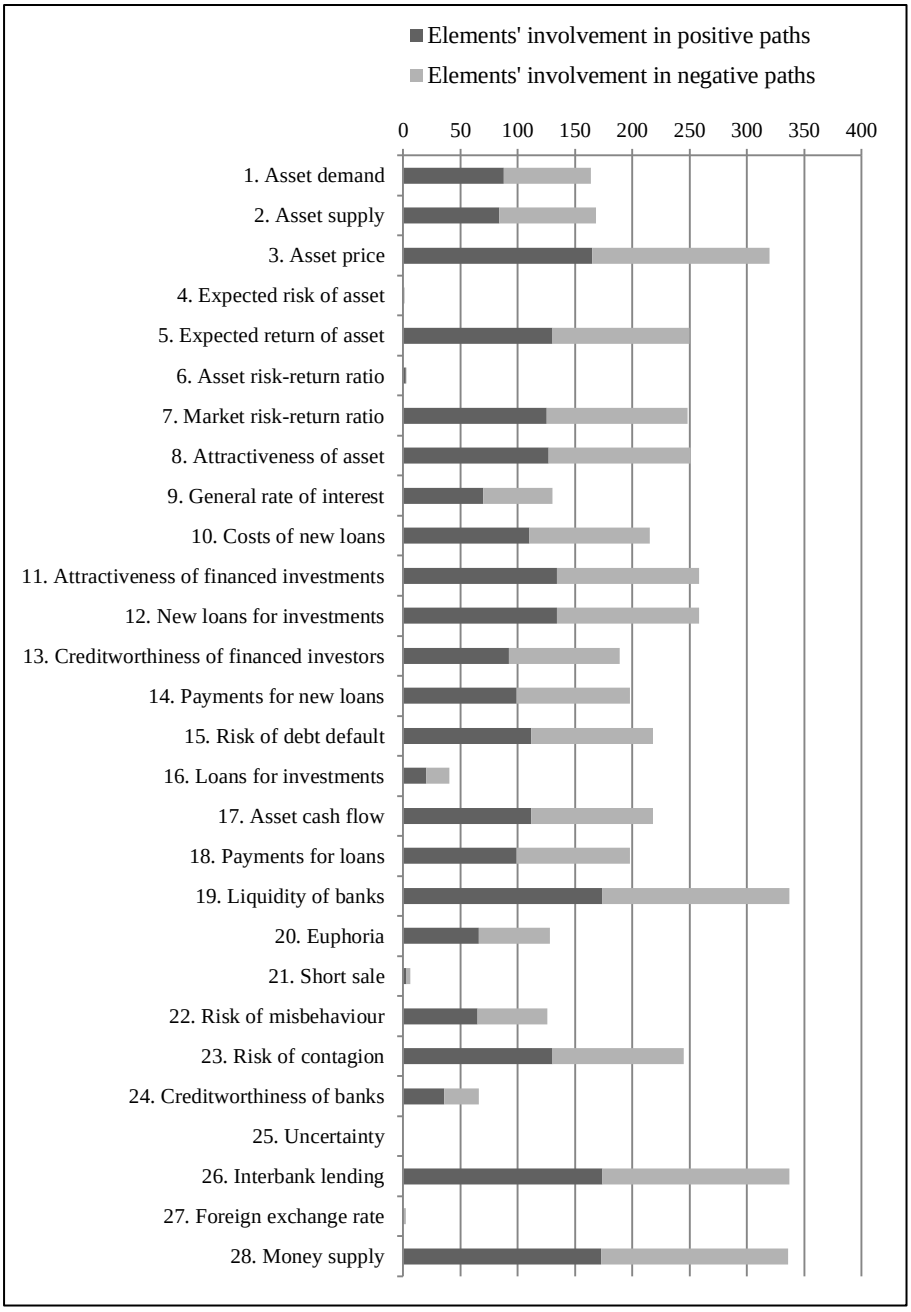


Figure 5-188: Involvement of elements in paths from Element 26 to Element 19 (from Element "Interbank lending" to Element "Liquidity of banks")

Interpretation: The initial impulse of increasing the Element "Interbank lending" slightly increases the Element "Liquidity of banks".

The initial impulse of decreasing the Element "Interbank lending" slightly decreases the Element "Liquidity of banks".

Paths from Element 26 (Interbank lending) to Element 27 (Foreign exchange rate)

Results: The initial impulse of an increase of the Element "Interbank lending" leads to an increase of the Element "Foreign exchange rate" in 0 cases. In 2 cases the initial impulse of an increase of the Element "Interbank lending" leads to a decrease of the Element "Foreign exchange rate".
The initial impulse of a decrease of the Element "Interbank lending" leads to a decrease of the Element "Foreign exchange rate" in 0 cases. In 2 cases the initial impulse of a decrease of the Element "Interbank lending" leads to an increase of the Element "Foreign exchange rate".
For a detailed list of paths please refer to Appendix 4.

Interpretation: The initial impulse of increasing the Element "Interbank lending" decreases the Element "Foreign exchange rate".

The initial impulse of decreasing the Element "Interbank lending" increases the Element "Foreign exchange rate".

Summary of results

The impact of actions can be measured by identifying effects caused by positive or negative paths to another element. The background is described in Chapter 3.3.4. The results of the analyses are summarised in Table 5-6. The table shows for each potential new action, their impact on the key elements, including overall number of paths, number of positive paths and number of negative paths.

All elements are capable of increasing asset prices. While the majority of potential actions slightly increases asset prices, the potential new actions of "Decreasing of asset supply" [#2b], "Decreasing of expected risk of asset" [#4b], "Increasing of asset risk-return ratio" [#6a], "Decreasing of market risk-return ratio" [#7b], "Increasing of attractiveness of asset" [#8a] and "Increasing of risk of contagion" [#23a] increase asset prices significantly.

Almost all elements slightly increase or slightly decrease the liquidity of banks. Only the Elements "Payments for new loans" [#14] and "Payments for loans" [#18] neither increase nor decrease the liquidity of banks. There is no potential new action that has a significant impact on the liquidity of banks.

The Elements Asset supply [#2], Expected risk of asset [#4], Asset risk-return ratio [#6], Market risk-return ratio [#7], Attractiveness of asset [#8] and Short sales [#21] neither increase nor decrease the foreign exchange rate. While a few potential new actions slightly increase the foreign exchange rate, the potential new actions "Increasing of costs of new loans" [#10a], "Decreasing of attractiveness of financed investments" [#11b], "Decreasing of new loans for investments" [#12b], "Decreasing of creditworthiness of financed investors" [#13b], "Decreasing of payments for new loans" [#14b], "Increasing of risk of debt default" [#15a], "Increasing of loans for investments" [#16a], "Decreasing of asset cash flow" [#17b], "Increasing of uncertainty" [#25a], "Decreasing of interbank lending" [#26b] and "Decreasing of money supply" [#28b] significantly increase the foreign exchange rate.

Table 5-6: Summary of the impact of potential new actions

#	Potential new action	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
1b[24]	Decreasing of asset demand	↘[25] 12-6-6	↗ 241-118-123	↘ 78-40-38
2a	Increasing of asset supply	↓ 1-0-1	↘ 136-67-69	→[25] 54-26-28
2b	Decreasing of asset supply	↑ 1-0-1	↗ 136-67-69	→[25] 54-26-28
4a	Increasing of expected risk of asset	↓ 6-2-4	↗ 283-147-136	→[25] 90-44-46
4b	Decreasing of expected risk of asset	↑ 6-2-4	↘ 283-147-136	→[25] 90-44-46
5a	Increasing of expected return of asset	↗ 181-94-87	↗ 230-116-114	↘ 62-30-32
5b	Decreasing of expected return of asset	↘ 181-94-87	↘ 230-116-114	↗ 62-30-32
6a	Increasing of asset risk-return ratio	↑ 6-4-2	↘ 283-136-147	→[25] 90-46-44
6b	Decreasing of asset risk-return ratio	↓ 6-4-2	↗ 283-136-147	→[25] 90-46-44

[24] Data based on analyses of the previous section

[25] A difference in the lengths of positive and negative paths causes a deviation of the normal effect.

#	Potential new action	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
7a	Increasing of market risk-return ratio	↓ 6-2-4	↗ 283-147-136	→[25] 90-44-46
7b	Decreasing of market risk-return ratio	↑ 6-2-4	↘ 283-147-136	→[25] 90-44-46
8a	Increasing of attractiveness of asset	↑ 6-4-2	↘ 283-136-147	→[25] 90-46-44
8b	Decreasing of attractiveness of asset	↓ 6-4-2	↗ 283-136-147	→[25] 90-46-44
10a	Increasing of costs of new loans	↘ 130-64-66	↘ 126-60-66	↑ 80-44-36
10b	Decreasing of costs of new loans	↗ 130-64-66	↗ 126-60-66	↓ 80-44-36
11a	Increasing of attractiveness of financed investments	↗ 102-52-50	↘ 136-66-70	↓[25] 66-32-34
11b	Decreasing of attractiveness of financed investments	↘ 102-52-50	↗ 136-66-70	↑[25] 66-32-34
12a	Increasing of new loans for investments	↗ 102-52-50	↘ 136-66-70	↓[25] 66-32-34
12b	Decreasing of new loans for investments	↘ 102-52-50	↗ 136-66-70	↑[25] 66-32-34
13a	Increasing of creditworthiness of financed investors	↗ 130-66-64	↗ 126-66-60	↓ 80-36-44
13b	Decreasing of creditworthiness of financed investors	↘ 130-66-64	↘ 126-66-60	↑ 80-36-44
14a	Increasing of payments for new loans	↘ 111-54-57	→ 130-65-65	↓ 72-34-38
14b	Decreasing of payments for new loans	↗ 111-54-57	→ 130-65-65	↑ 72-34-38
15a	Increasing of risk of debt default	↘ 73-35-38	↘ 179-87-92	↑ 2-2-0
15b	Decreasing of risk of debt default	↗ 73-35-38	↗ 179-87-92	↓ 2-2-0
16a	Increasing of loans for investments	↘ 130-64-66	↘ 126-60-66	↑ 80-44-36
16b	Decreasing of loans for investments	↗ 130-64-66	↗ 126-60-66	↓ 80-44-36

#	Potential new action	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
17b[24]	Decreasing of asset cash flow	↘ 73-38-35	↘ 179-92-87	↑ 2-0-2
18a[24]	Increasing of payments for loans	↘ 111-54-57	→ 130-65-65	↓ 72-34-38
19b[24]	Decreasing of liquidity of banks	→ 54-27-27	↓ n/a	↗ 90-44-46
20a	Increasing of euphoria	↗ 194-101-93	↗ 448-227-221	↘ 138-68-70
20b	Decreasing of euphoria	↘ 194-101-93	↘ 448-227-221	↗ 138-68-70
21a[24]	Increasing of short sales	↘[25] 13-6-7	↘ 375-184-191	→ 120-60-60
22a	Increasing of risk of misbehaviour	↗ 187-96-91	↗ 401-204-197	↘ 128-62-66
22b	Decreasing of risk of misbehaviour	↘ 187-96-91	↘ 401-204-197	↗ 128-62-66
23a	Increasing of risk of contagion	↑ 19-10-9	↘ 208-100-108	↗ 84-44-40
23b	Decreasing of risk of contagion	↓ 19-10-9	↗ 208-100-108	↘ 84-44-40
24b[24]	Decreasing of creditworthiness of banks	↑ 19-9-10	↘ 208-108-100	↗ 84-40-44
25a[24]	Increasing of uncertainty	↘ 148-72-76	↘ 337-163-174	↑ 2-2-0
26a	Increasing of interbank lending	↗ 148-76-72	↗ 337-174-163	↓ 2-0-2
26b	Decreasing of interbank lending	↘ 148-76-72	↘ 337-174-163	↑ 2-0-2
28b[24]	Decreasing of money supply	↘ 136-69-67	↘ 455-235-220	↑ 2-0-2

Legend

↑ Significant increase	↗ Slight increase	→ No effect	↘ Slight decrease	↓ Significant decrease

The last two parts of the thesis concentrated on the analysis of the effects of actions on key elements of the developed financial crisis system. The next section combines all conducted analyses.

5.4 Summary of effectiveness of actions

This section summarises the analyses of the previous Chapters 5.1, 5.2 and 5.3.

5.4.1 Summary of effectiveness of identified actions

Table 5-7 summarises the analyses of Chapters 5.1.1, 5.2.1 and 5.3.1 for identified actions.

Effectiveness of central bank actions

The majority of actions can be seen as sustainable or slightly sustainable. The actions "Extension of money supply" [#1-1] and direct foreign exchange interventions [#1-4, #1-5] are unsustainable. The actions "Extension of money supply" [#1-1] and the increasing or decreasing of the general rate of interest [#1-2, #1-3] are powerful enough to change the systems behaviour without risking an overregulation.

Asset prices might be pushed by the actions "Extension of money supply" [#1-1], "Decreasing of the general interest rate" [#1-3] and "Asset purchases from markets" [#1-6]. All actions but "Increasing of general interest rate" [#1-2], "Depreciation of domestic currency" [#1-5] and "Asset purchases from markets" [#1-6] improve the liquidity of banks. The majority of actions dilute the foreign exchange rate. Only the actions "Increasing of general interest rate" [#1-2], a direct foreign exchange intervention [#1-4] and "Asset purchases from markets" [#1-6] might appreciate the domestic currency.

Lender of last resort

Actions of the lender of last resort can be seen as slightly sustainable. However, they are not powerful enough to change the systems behaviour. The asset price might be increased by the action "Provision of liquidity to financed investors" [#2-2]. The liquidity of banks is positively affected by all actions of the lender of last resort [#2-1, #2-2 and #2-3]. However, the foreign exchange rate decreases.

Effectiveness of actions of governments and regulators

Almost all actions are slightly sustainable. Only the actions “Debt moratoria for financed investors” [#3-4] and the “Prohibition of short sales” [#3-9] are unsustainable. The action “Debt moratoria for financed investors” [#3-4] is adequate to change the system’s behaviour. There is a high risk of overregulation by applying the action “Bank holidays on exchanges” [#3-7].

The actions “Debt moratoria for financed investors” [#3-4], “Bank holidays on exchanges” [#3-7], “Stress tests” [#3-8] and “Prohibition of short sales” [#3-9] are capable of increasing the price of assets. Almost all actions increase the liquidity of banks. Only “Debt moratoria for financed investors” does not show a specific effect [#3-4]. These positive effects are mostly attended by a reduction of the foreign exchange rate. Only the action “Debt moratoria for financed investors” [#3-4] causes positive effects. The actions “Bank holidays on exchanges” and “Prohibition of short sales” [#3-9] neither increase nor decrease the foreign exchange rate.

Table 5-7:Summary of effectiveness of identified actions

#	Action	Element	Sustainability	Systemic role	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
1-1	Extension of money supply	28: Money supply	-	Active	↗	↗	↓
1-2	Increasing of general interest rate	9: General rate of interest	+	Active	↘	↘	↗
1-3	Decreasing of general interest rate	9: General rate of interest	+	Active	↗	↗	↘
1-4	Appreciation of domestic currency	27: Foreign exchange rate	-	Buffering	→	↑	↑
1-5	Depreciation of domestic currency	27: Foreign exchange rate	-	Buffering	→	↓	↓
1-6	Asset purchases from markets	1: Asset demand	++	Passive	↗	↘	↗
1-7	Asset purchases from banks	19: Liquidity of banks	+	Passive	→	↑	↘
1-8	Lightening of collateral	24: Creditworthiness of banks	+	Buffering	↓	↗	↘
2-1	Provision of liquidity to banks	19: Liquidity of banks	+	Passive	→	↑	↘
2-2	Provision of liquidity to financed investors	17: Asset cash flow	+	Buffering	↗	↗	↓
2-3	Provision of foreign liquidity to banks	19: Liquidity of banks	+	Passive	→	↑	↘
3-1	Deposit insurance, guarantees and	24: Creditworthiness of banks	+	Buffering	↓	↗	↘
3-2	Asset purchase programme	19: Liquidity of banks	+	Passive	→	↑	↘
3-3	Asset transfer programme	24: Creditworthiness of banks	+	Buffering	↓	↗	↘
3-4	Debt moratoria for financed investors	18: Payments for loans	-	Active	↗	→	↑
3-5	Accounting discretion	24: Creditworthiness of banks	+	Buffering	↓	↗	↘
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	+	Passive	→	↑	↘
3-7	Bank holidays on exchanges	3: Asset price	+	Critical	↑	↗	→
3-8	Stress tests	25: Uncertainty	+	Buffering	↗	↗	↓
3-9	Prohibition of short sales	21: Short sales	-	Buffering	↗	↗	→

Legend

++ Sustainable	+ Slightly sustainable	- Unsustainable		

↑ Significant increase	↗ Slight increase	→ No effect	↘ Slight decrease	↓ Significant decrease

This section showed all the results of the analyses for identified actions. The next pages summarise the results for potential new actions.

5.4.2 Summary of effectiveness of potential new actions

Table 5-8 summarises the analyses of Chapters 5.1.2, 5.2.2 and 5.3.2 for potential new actions.

There are no potential new actions that are sustainable, strong enough to change the system behaviour and cause only positive impacts on asset prices, the liquidity of banks and the foreign exchange rate.

The majority of actions can be seen as sustainable or slightly sustainable. Only a few potential actions are powerful enough to change the systems behaviour.

The most promising potential new actions causing positive effects on asset prices and the liquidity of banks are the following:

- The potential new action “Increasing of expected return of asset” [#5a] causes positive effects on asset prices and the liquidity of banks. The potential new action is sustainable and powerful.
- The potential new actions “Decreasing of payments for new loans” [#14b] causes exclusively positive effects but the potential new action is neither sustainable nor powerful.

Table 5-8:Summary of effectiveness of potential new actions

#	Action	Sustainability	Systemic role	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
1b	Decreasing of asset demand	++	Passive	↘	↗	↘
2a	Increasing of asset supply	+	Passive	↓	↘	→
2b	Decreasing of asset supply	+	Passive	↑	↗	→
4a	Increasing of expected risk of asset	-	Buffering	↓	↗	→
4b	Decreasing of expected risk of asset	-	Buffering	↑	↘	→
5a	Increasing of expected return of asset	+	Active	↗	↗	↘
5b	Decreasing of expected return of asset	+	Active	↘	↘	↗
6a	Increasing of asset risk-return ratio	++	Buffering	↑	↘	→
6b	Decreasing of asset risk-return ratio	++	Buffering	↓	↗	→
7a	Increasing of market risk-return ratio	+	Passive	↓	↗	→
7b	Decreasing of market risk-return ratio	+	Passive	↑	↘	→
8a	Increasing of attractiveness of asset	+	Buffering	↑	↘	→
8b	Decreasing of attractiveness of asset	+	Buffering	↓	↗	→
10a	Increasing of costs of new loans	+	Buffering	↘	↘	↑
10b	Decreasing of costs of new loans	+	Buffering	↗	↗	↓
11a	Increasing of attractiveness of financed investments	+	Buffering	↗	↘	↓
11b	Decreasing of attractiveness of financed investments	+	Buffering	↘	↗	↑
12a	Increasing of new loans for investments	+	Active	↗	↘	↓
12b	Decreasing of new loans for investments	+	Active	↘	↗	↑
13a	Increasing of creditworthiness of financed investors	+	Passive	↗	↗	↓
13b	Decreasing of creditworthiness of financed investors	+	Passive	↘	↘	↑
14a	Increasing of payments for new loans	-	Buffering	↘	→	↓
14b	Decreasing of payments for new loans	-	Buffering	↗	→	↑

#	Action	Sustainability	Systemic role	Impact on asset price	Impact on liquidity of banks	Impact on foreign exchange rate
15a	Increasing of risk of debt default	+	Buffering	↘	↘	↑
15b	Decreasing of risk of debt default	+	Buffering	↗	↗	↓
16a	Increasing of loans for investments	-	Buffering	↘	↘	↑
16b	Decreasing of loans for investments	-	Buffering	↗	↗	↓
17b	Decreasing of asset cash flow	+	Buffering	↘	↘	↑
18a	Increasing of payments for loans	-	Active	↘	→	↓
19b	Decreasing of liquidity of banks	+	Passive	→	↓	↗
20a	Increasing of euphoria	+	Buffering	↗	↗	↘
20b	Decreasing of euphoria	+	Buffering	↘	↘	↗
21a	Increasing of short sales	-	Buffering	↘	↘	→
22a	Increasing of risk of misbehaviour	+	Buffering	↗	↗	↘
22b	Decreasing of risk of misbehaviour	+	Buffering	↘	↘	↗
23a	Increasing of risk of contagion	+	Active	↑	↘	↗
23b	Decreasing of risk of contagion	+	Active	↓	↗	↘
24b	Decreasing of creditworthiness of banks	+	Buffering	↑	↘	↗
25a	Increasing of uncertainty	+e	Buffering	↘	↘	↑
26a	Increasing of interbank lending	+	Buffering	↗	↗	↓
26b	Decreasing of interbank lending	+	Buffering	↘	↘	↑
28b	Decreasing of money supply	-	Active	↘	↘	↑

Legend

++ Sustainable	+ Slightly sustainable	- Unsustainable		

↑ Significant increase	↗ Slight increase	→ No effect	↘ Slight decrease	↓ Significant decrease

The last two sections contain a summary of all conducted analyses. Every single action is assessed regarding sustainability, strength and impact on key elements. The next section focuses on the combination of actions.

5.5 Interferences of actions

This section shows the interferences of identified actions and promising new actions. The details of the method are described in Chapter 3.3.5. The majority of effective actions decrease the foreign exchange rate. This aspect leads to different results for domestic and international financial crises. More of containment actions can be applied during a crisis if the foreign exchange rate is ignored. This might happen in case of an international financial crisis. Economically leading countries caught up in a crisis can coordinate their exchange rate policies. In contrast, in the case of a domestic crisis, only a few options are available. Therefore, international financial crises can be defined by an affection of economically leading countries. Domestic financial crises are defined by an affection of a single country or various countries without affection of economically leading countries. A first overview shows the results for domestic financial crisis in which all three desired key goals shall be achieved. A second overview shows the results for an international financial crisis where, in special circumstances, just two key goals have to be achieved.

Results (I) Effects on <u>asset price, liquidity of banks and foreign exchange rate</u>

An intended effect of actions might be neutralised by other actions. Table 5-9 and Figure 5-189 show recommendable combinations of actions to reach an intended impact on the three Elements “Asset price”, “Liquidity of banks” and “Foreign exchange rate” linked to desired key goals.

The results of the analysis suggest that countries, which face a domestic and isolated financial crisis, may use only a few actions to reach the goals of increased asset prices, liquidity of banks and stable foreign exchange rates. They are listed on the side of the table. The actions “Appreciation of domestic currency” [#1-4], “Debt moratoria for financed investors” [#3-4], “Bank holidays on exchanges” [#3-7] and “Prohibition of short sales” [#3-9] should be simultaneously be applied. A potential new action could be “Decreasing of payments for new loans” [#14b]. All other actions have at least one negative effect on the key elements “Asset price”, “Liquidity of banks” and “Foreign

exchange rate" (interferences). Within the visualised system, the relevant elements are highlighted in dark grey.

The background is explained in Chapter 3.3.5 and based on the results of Chapter 5.3 analysing the effects of the actions on the key elements of the system.

Table 5-9: Results of interferences of actions (I)

Combination of actions without interferences		Combination of actions with interferences	
#	Action	#	Action
1-4	Appreciation of domestic currency	1-1	Extension of money supply
3-4	Debt moratoria for financed investors	1-2	Increasing of general interest rate
3-7	Bank holidays on exchanges	1-3	Decreasing of general interest rate
3-9	Prohibition of short sales	1-5	Depreciation of domestic currency
14b	*Decreasing of payments for new loans*	1-6	Asset purchases from markets
		1-7	Asset purchases from banks
		1-8	Lightening of collateral requirements
		2-1	Provision of liquidity to banks
		2-2	Provision of liquidity to financed investors
		2-3	Provision of foreign liquidity to banks
		3-1	Deposit insurance, guarantees and nationalisation
		3-2	Asset purchase programme
		3-3	Asset transfer programme
		3-5	Accounting discretion
		3-6	Deposit freezing or bank holidays
		3-8	Stress tests
		5a	*Increasing of expected return of asset*

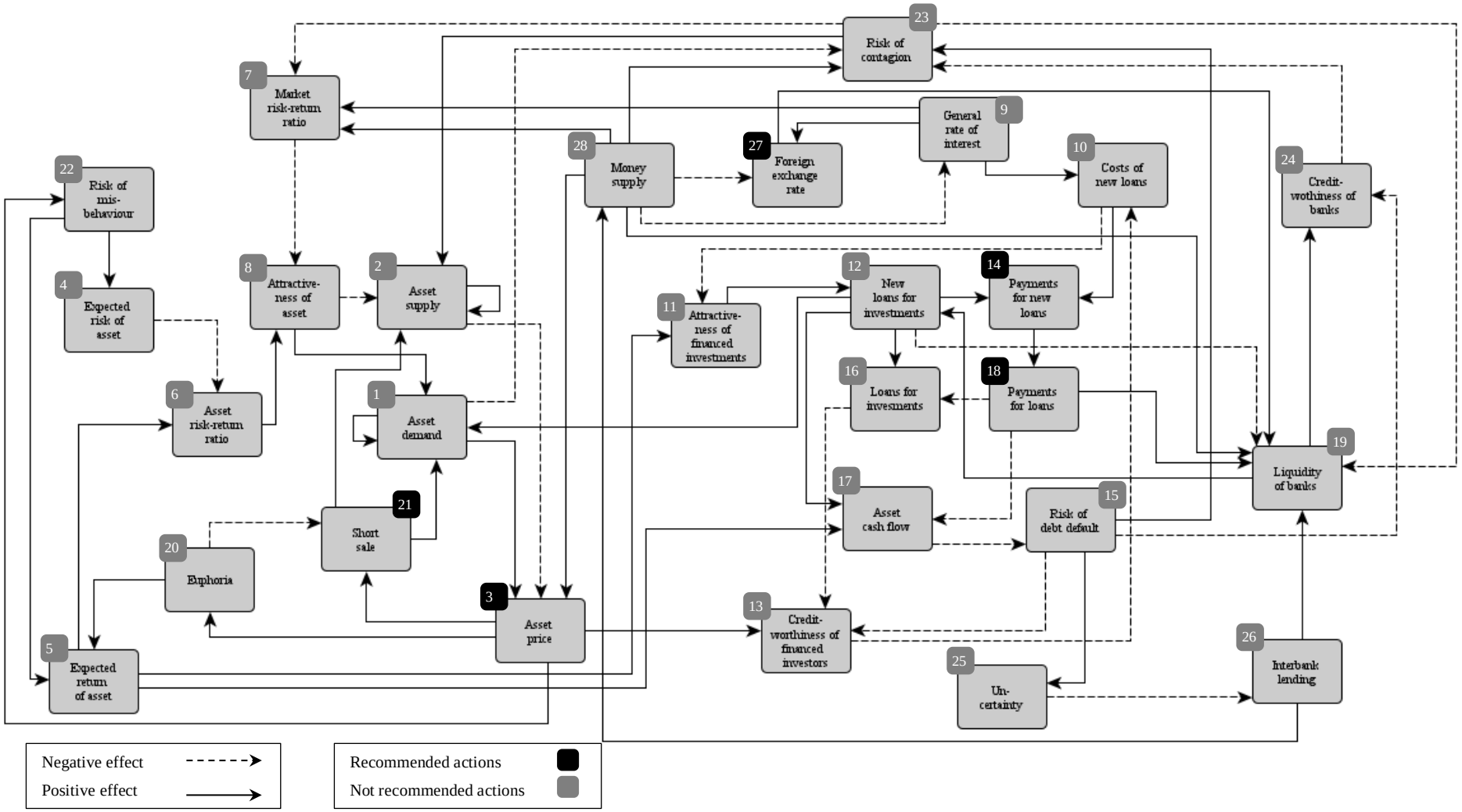


Figure 5-189: Results of interferences of actions (I)

Results (II) Effects on <u>asset price and liquidity of banks</u>

An intended effect of actions might be neutralised by other actions. Table 5-10 and Figure 5-190 show recommendable combinations of actions to achieve an intended impact on the two key elements “Asset price” and “Liquidity of banks”.

An international financial crisis might be handled differently compared to domestic crises. Central banks may arrange a harmonised monetary policy resulting in a stable foreign exchange rate for the most important currencies. In this case, the majority of the actions might be applied to increase the asset price and the liquidity of banks without any neutralisations (left side of the table). However, the actions “Increasing of general interest rate” [#1-2], “Depreciation of domestic currency” [#1-5], “Asset purchases from markets” [#1-6], and the increasing of banks’ creditworthiness [#1-8, #3-1, #3-3 and #3-5] should not be applied due to the neutralising effects (interferences). Within the visualised system, the relevant elements are highlighted in dark grey.

The background is explained in Chapter 3.3.5 and based on the results of Chapter 5.3 analysing the effects of the actions on the key elements of the system.

Table 5-10: Results of interferences of actions (II)

Combination of actions without interferences		Combination of actions with interferences	
#	**Action**	**#**	**Action**
1-1	Extension of money supply	1-2	Increasing of general interest rate
1-3	Decreasing of general interest rate	1-5	Depreciation of domestic currency
1-4	Appreciation of domestic currency	1-6	Asset purchases from markets
1-7	Asset purchases from banks	1-8	Lightening of collateral requirements
2-1	Provision of liquidity to banks	3-1	Deposit insurance, guarantees and nationalisation
2-2	Provision of liquidity to financed investors	3-3	Asset transfer programme
2-3	Provision of foreign liquidity to banks	3-5	Accounting discretion
3-2	Asset purchase programme		
3-4	Debt moratoria for financed investors		
3-6	Deposit freezing or bank holidays		
3-7	Bank holidays on exchanges		
3-8	Stress tests		
3-9	Prohibition of short sales		
5a	*Increasing of expected return of asset*		
14b	*Decreasing of payments for new loans*		

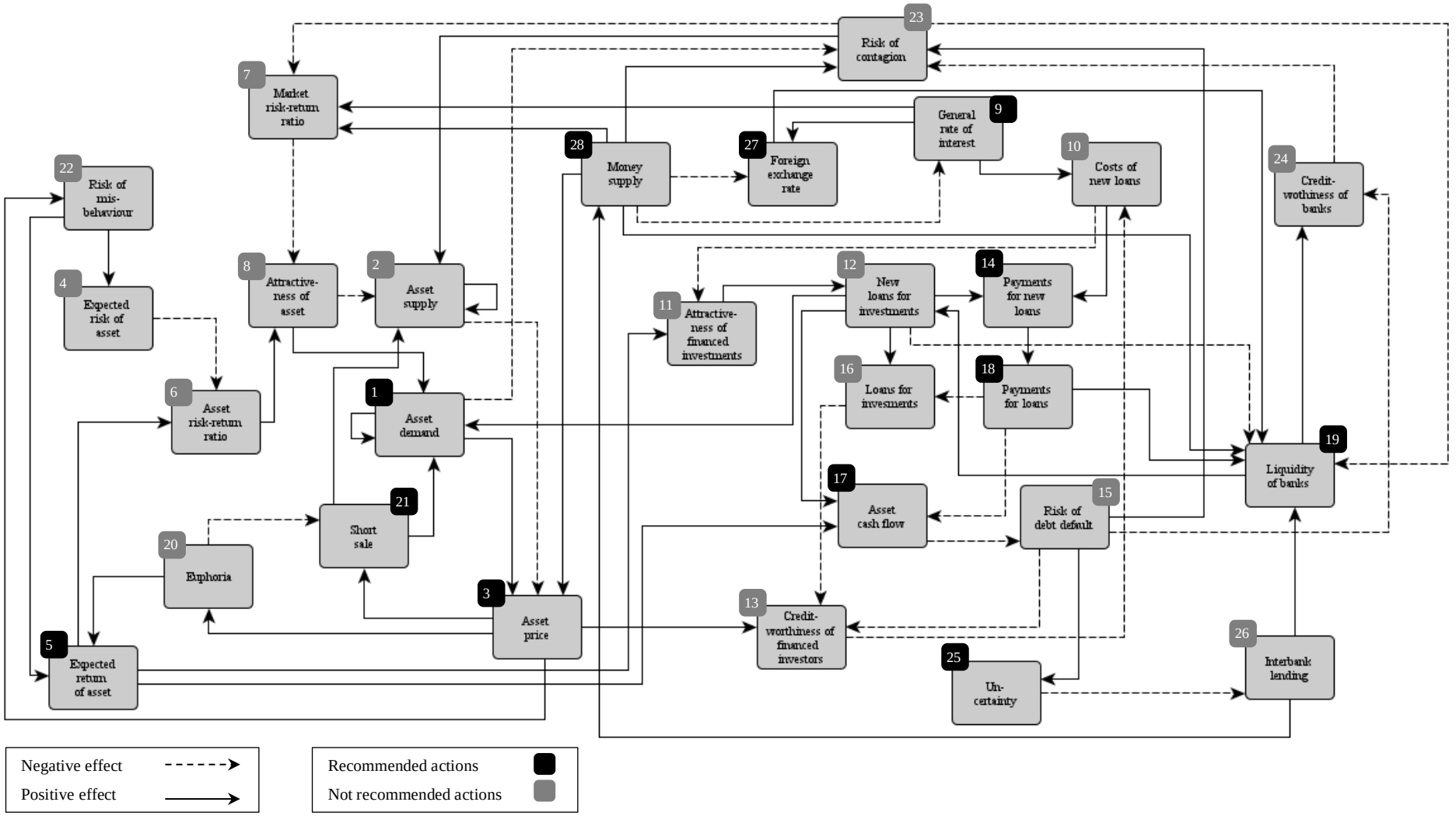


Figure 5-190: Results of interferences of actions (II)

The fifth chapter contains all the results of the systemic analysis. The sustainability of actions, their strength and impact were separately illustrated in the first three sections. Section four combined them for each action and the last section showed the recommendable combination of actions. The next chapter evaluates these results.

6 Historical evaluation of prior containment actions

The first phase of this research focussed on the prioritisation of financial crisis actions. Their effectiveness was analysed, including the aspects of sustainability, strength, impact on key indicators and interferences (see Chapter 5). The historical evaluation strives to strengthen the results of the complex system approach. The methodological reasoning is documented in Chapter 3.4.

This chapter contains the sections “Historical financial crises” and “Evaluation of historical information”. Chapter 6.1 starts with a description of criteria for the selection of financial crises. In addition, it contains facts about applied containment actions and general information about the crises. The information is available for six financial crises. Chapter 6.2 shows the aggregated information of Chapter 6.1 and evaluates them by matching the information concerning the applied recommended actions and applied not-recommended actions with the criteria of successfully handled crises.

6.1 Historical financial crises

This section collects information of historical financial crises that are required for a historical evaluation of the systemic results of Chapter 5.

Chapter 6.1.1 explains the reason for the selection of the financial crises. There is one limiting factor for the analysis. There are only a few databases about financial crises containment available. They are listed and which evaluation criteria of financial crises containment handling are applied has been mentioned.

Chapters 6.1.2 to 6.1.7 show the facts of the financial crises in Sweden 1991, Norway 1991, Thailand 1997, Russia 1998, UK 2008 and USA 2008. Next to information about applied and not applied containment actions, information about asset prices, bank closures and currency crashes are also collected. All sources of information are listed in tables.

6.1.1 Selection criteria of financial crises

Two different types of inputs are required for a complete data set of a historical financial crisis. This section describes the basic approach to data collection about applied containment actions and outlines three indicators showing the success of financial crisis management.

There are several scientific publications that can be seen as financial crises databases containing structured information about characteristics of financial crises. Reinhart and Rogoff (2009) have collected information of financial crises, listing those that occurred in the last eight centuries with description of their main features. Unfortunately, their database does not contain sufficient information of containment actions. This information is provided by other databases. Laeven and Valencia are good sources (Laeven and Valencia, 2008; Laeven and Valencia, 2010; Laeven and Valencia, 2012; Laeven and Valencia, 2013). In addition, scientists have published on the application of containment actions. If no information is available, the default assumption would be that the action had not been applied.

Gelpern (2009) defines increased asset prices, increased liquidity of banks and stable foreign exchange rates as the three key goals of financial crisis management. They are also used to evaluate the success of historical financial crisis containment actions. The duration of asset price recoveries might be a good indicator of asset prices. Reinhart and Rogoff (2014) apply the duration to a similar analysis. They analysed the gross domestic product (GDP) instead of the asset price recovery. For the analysis, the most important stock index of the affected country has been chosen. The start of the crisis is mentioned in the database of Laeven and Valencia (2008). However, from a financial point of view, the starting date differs partly. According to Vines (2003), a crisis begins if there is a drop of more than 5% a day. Sometimes the drop is less intensive. In this case, the definition of Baro and Ursúa (2009), according to which a crisis begins when there is a downturn and a loss of 25% within twelve months, has been checked. The crisis ends when the pre-crisis value is regained. The time is measured by calendar days instead of actual trading days. Intraday developments are not considered. The analyses are based on the closing prices. High bank liquidity is essential to prevent their bankruptcy. Therefore, the occurrence of bank closures might be seen as an indirect indicator of liquidity of banks. Laeven and Valencia

(2008) provide an overview of bank closures that occurred during the mentioned financial crises. They counted all the banks that closed down within three years of the burst. A stable foreign exchange rate can be defined as an avoided devaluation of 30% within 12 months. Otherwise, it can be seen as a currency crash. Laeven and Valencia (2008) provide an overview of currency crashes. Their approach is built on the approach of Frankel and Rose (1996).

This section explained the criteria to select financial crises and which information need to be captured. The next pages gather those information for six financial crises.

6.1.2 Financial crisis in Sweden 1991

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not recommended actions.

The Swedish financial crisis followed a prior phase of boom initiated by financial deregulation (Jonung et al., 2008). Consequently, too many real estate loans were granted based on too optimistic risk assessments. Riskier loans were booked in off-balance sheet entities. In the end, the crisis was caused by bad banking and inadequate policies (Ingves and Lind, 2008).

The crisis started in September 1991 (Laeven and Valencia, 2008). The Swedish stock market index OMXS30 reflects the Swedish equity market and comprises 30 shares that are listed on NASDAQ OMX exchange and have the largest trading volume (Nasdaq OMX, 2014). This index had already dropped on August 19th 1991 by about seven percent, conforming to the definition of Vines (2003) who says price drops of more than five percent a day can be seen as an unusual event. The index regained the pre-crisis level after 625 days on May 5th 1993.[26] Figure 6-1 shows the development of the index during the crisis (Data downloaded from http://www.yahoo.com).

[26] The short asset price recovery of end of August 1991 is not considered due to its unsustainability.

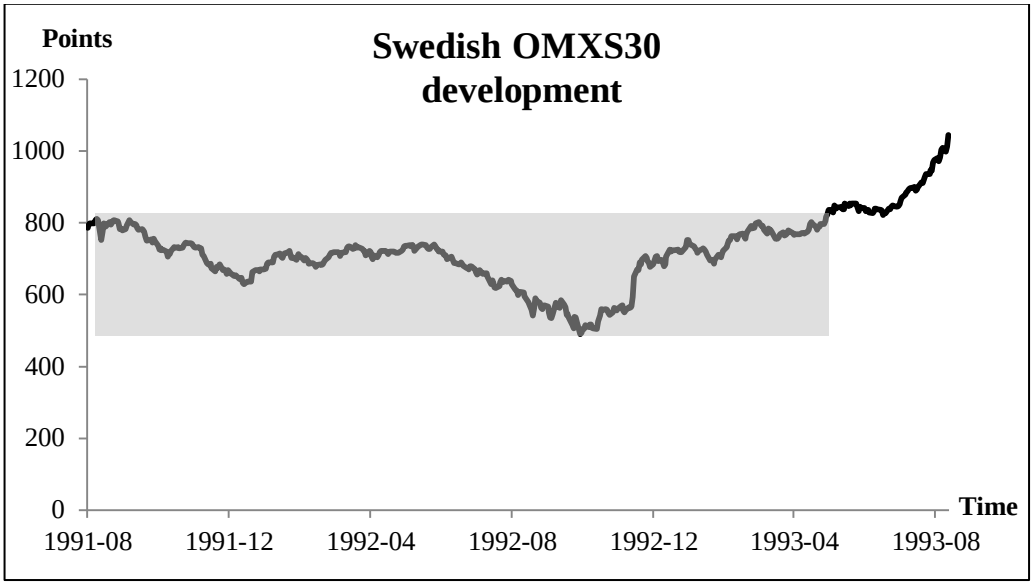


Figure 6-1: Swedish OMX development

According to Laeven and Valencia (2008) there were no closures of banks but a currency crisis had occurred. During the financial crisis, the value of the Swedish currency fluctuated from a minimum of 5.0885 for one U.S. Dollar (September 2nd 1992) to a maximum of 7.8470 for one U.S. Dollar (February 25th 1993). This devaluation of 54% within 12 months can be seen as a currency crash. The fluctuation is higher than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-2 shows the Swedish Krona development (Data downloaded from http://www.stlouisfed.org).

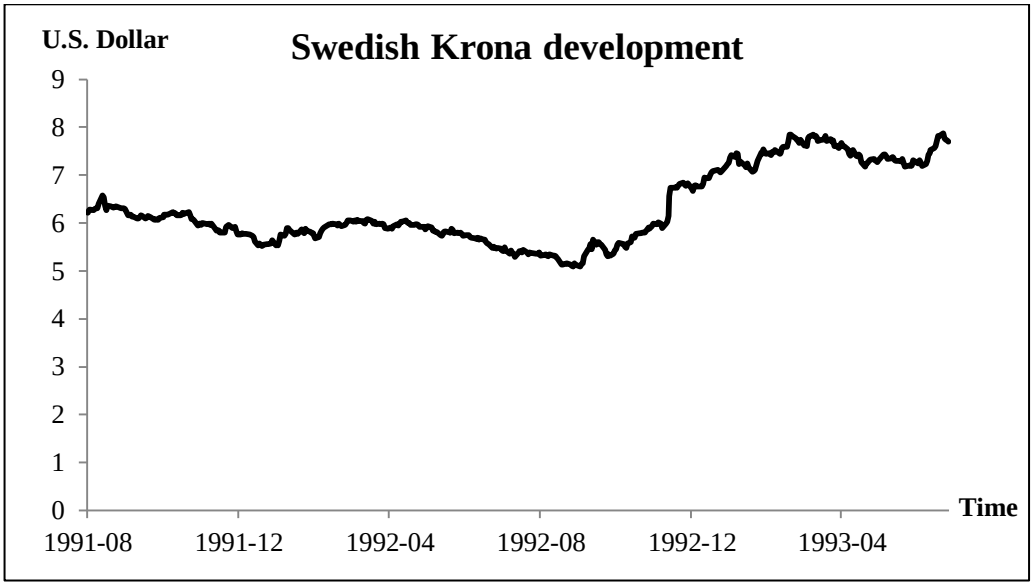


Figure 6-2: Swedish Krona development

This Swedish financial crisis can be classified as domestic. Economically leading countries were not affected.

Table 6-1: Facts of the financial crisis in Sweden 1991

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
Sweden	1991	Domestic	625	No	Yes

Table 6-2 shows the applied containment actions during the Swedish financial crisis, including the source of information. Figure 6-3 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-2: Containment actions in Sweden 1991

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	Yes	Laeven and Valencia (2008)	
1-2	Increasing of general interest rate	9: General rate of interest	Yes	Ingves et al. (2009)	
1-3	Decreasing of general interest rate	9: General rate of interest	No		default value: no evidence for application found
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No		default value: no evidence for application found
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes	Ingves et al. (2009)	
1-6	Asset purchases from markets	1: Asset demand	No		default value: no evidence for application found
1-7	Asset purchases from banks	19: Liquidity of banks	No		default value: no evidence for application found
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No		default value: no evidence for application found
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			Yes	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		summary

#	Action	Element	Applied	Source	Comment
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	No		default value: no evidence for application found
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Laeven and Valencia (2008)	labelled as "nationalizations"
			No	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes	Demirgüç-Kunt et al. (2015)	deposit insurance
			Yes		summary
3-2	Asset purchase programme	19: Liquidity of banks	No		default value: no evidence for application found
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes	Laeven and Valencia (2008)	labelled as "asset management company"
3-4	Debt moratoria for financed investors	18: Payments for loans	No		default value: no evidence for application found
3-5	Accounting discretion	24: Creditworthiness of banks	No	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	8: Asset price	No		default value: no evidence for application found
3-8	Stress tests	25: Uncertainty	No		default value: no evidence for application found
3-9	Prohibition of short sales	21: Short sales	No		default value: no evidence for application found

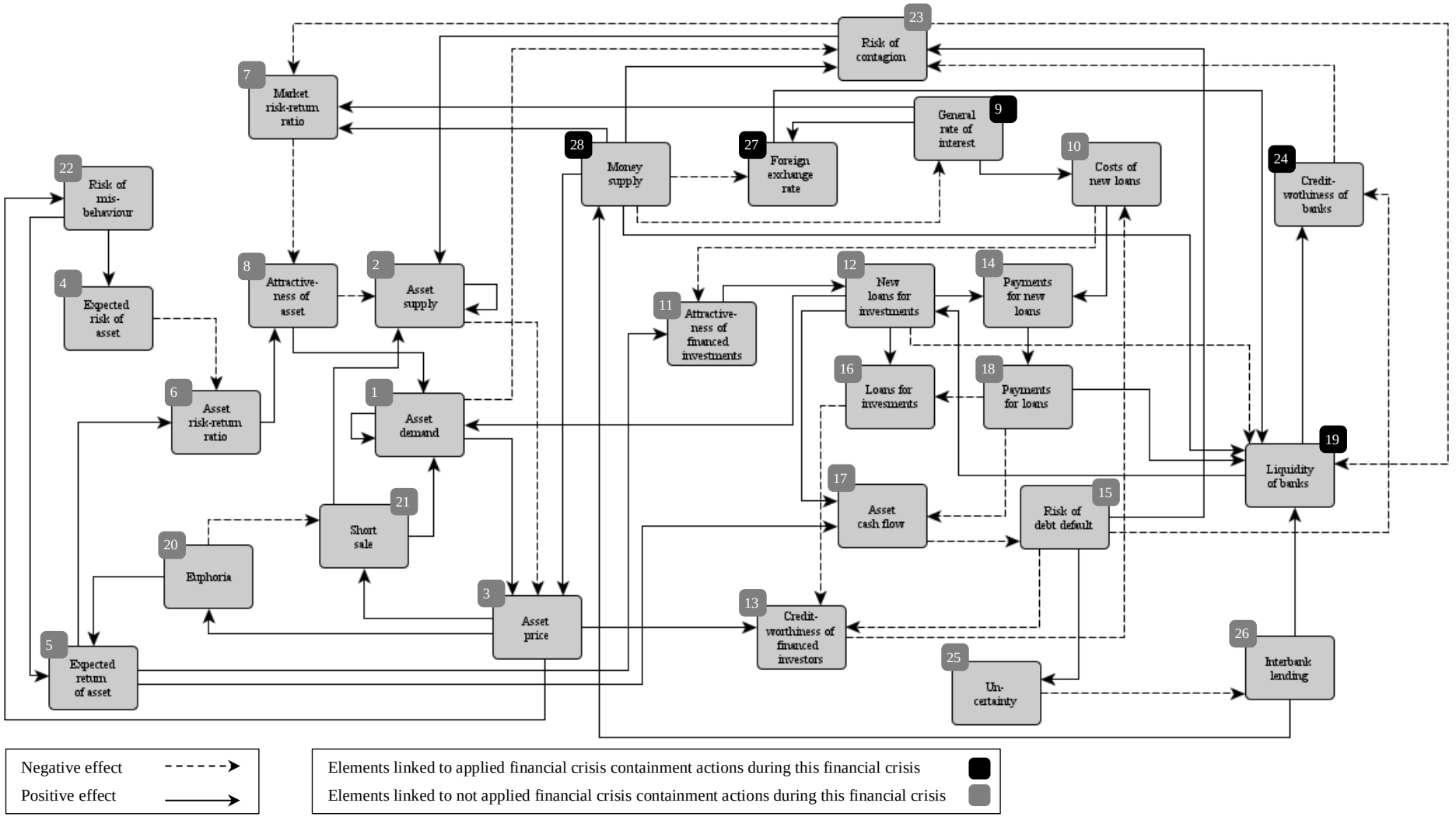


Figure 6-3: Containment actions in Sweden 1991

According to the results of complex system approach four containment actions should be applied when domestic financial crises occur. Table 6-3 shows their application during the Swedish financial crisis. None of these actions were applied.

Table 6-3: Applied recommended containment actions in Sweden 1991

#	Action	Element	Applied
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-7	Bank holidays on exchanges	3: Asset price	No
3-9	Prohibition of short sales	21: Short sales	No

According to the results of complex system approach the majority of possible containment actions should not be applied in case of domestic financial crises. Table 6-4 shows their application during the Swedish financial crisis. Seven of these actions were applied. Two of them are linked to active elements (actions [#1-1], [#1-2]).

Table 6-4: Applied not-recommended containment actions in Sweden 1991

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	Yes
1-2	Increasing of general interest rate	9: General rate of interest	Yes
1-3	Decreasing of general interest rate	9: General rate of interest	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes
1-6	Asset purchases from markets	1: Asset demand	No
1-7	Asset purchases from banks	19: Liquidity of banks	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	Yes
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes
3-5	Accounting discretion	24: Creditworthiness of banks	No
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-8	Stress tests	25: Uncertainty	No

6.1.3 Financial crisis in Norway 1991

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not-recommended actions.

The Norwegian financial crisis followed a prior phase of boom, which was initiated by financial deregulation. Consequently, too many loans were granted based on too optimistic risk assessments (Moe et al., 2004).

The crisis started in October 1991 (Laeven and Valencia, 2008). The Norwegian stock market index OBXP reflects the Norwegian equity market and consists 25 most traded securities on Oslo Børs (Oslo Bors, 2014). This index dropped already on August 19th 1991 by more than ten percent, conforming to the definition of Vines (2003) who says price drops of more than five percent a day can be seen as an unusual event. The index regained the pre-crisis level after 884 days on January 19th 1994.[27] Figure 6-4 shows the development of the index during the crisis (Data kindly provided by Norwegian securities exchange Oslo Børs).

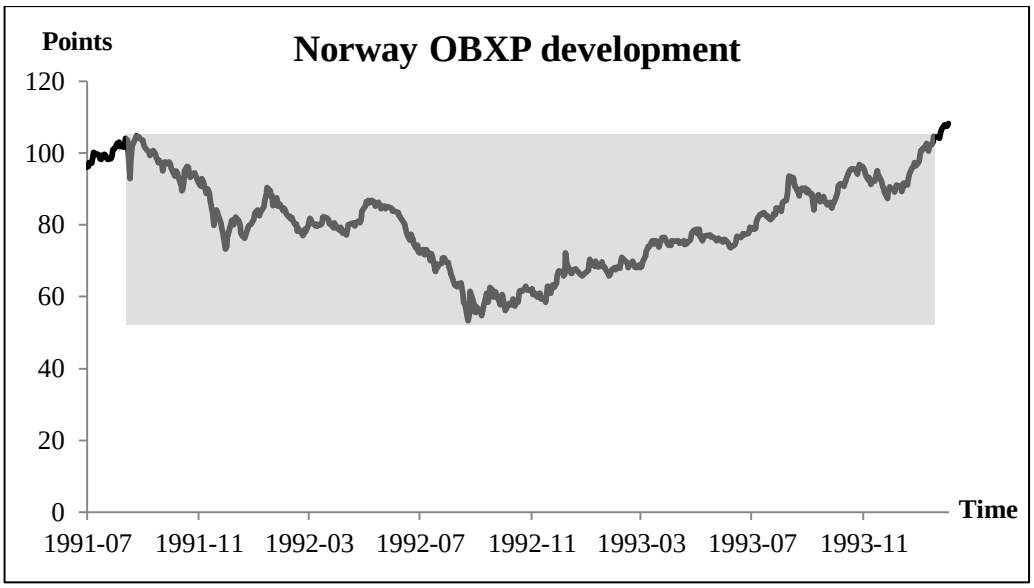


Figure 6-4: Norwegian OBXP development

[27] The short asset price recovery of end of August 1991 is not considered due to its unsustainability.

According to Laeven and Valencia (2008) there were closures of banks but a currency crisis had not occurred. During the financial crisis, the value of the Norwegian currency fluctuated from a minimum of 5.5095 for one U.S. Dollar (September 2nd 1992) to a maximum of 7.3830 for one U.S. Dollar (July 7th 1993). This devaluation of 25% within 12 months cannot be seen as a currency crash. The fluctuation is lower than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-5 shows the Norwegian Kroner development (Data downloaded from http://www.stlouisfed.org).

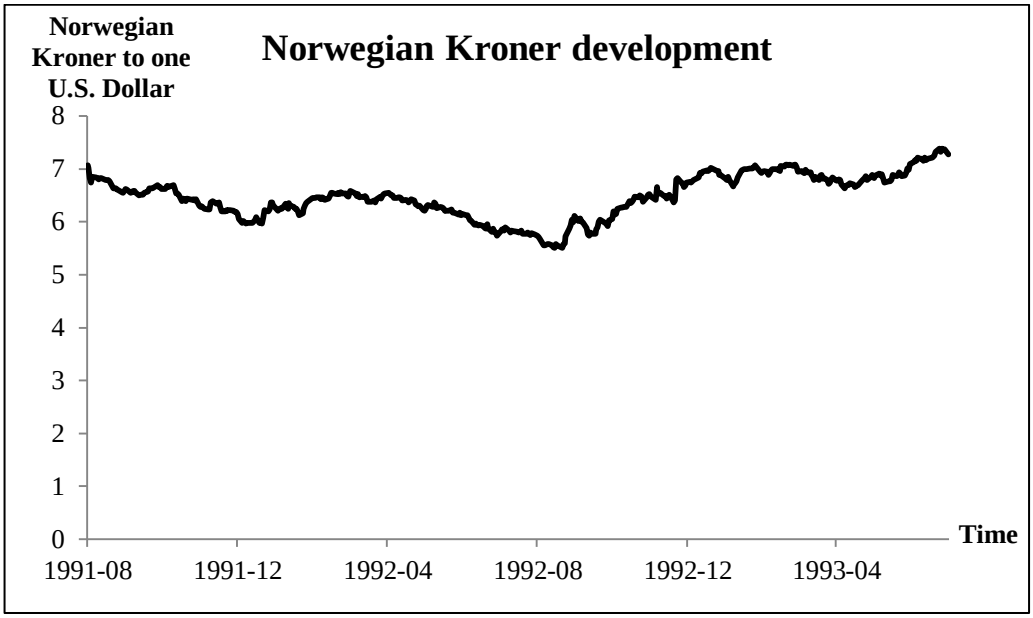


Figure 6-5: Norwegian Kroner development

This Norwegian financial crisis can be classified as domestic. Economically leading countries were not affected.

Table 6-5: Facts of the financial crisis in Norway 1991

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
Norway	1991	Domestic	884	Yes	No

Table 6-6 shows the applied containment actions during the Norwegian financial crisis, including the source of information. Figure 6-6 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-6: Containment actions in Norway 1991

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	No	Laeven and Valencia (2008)	
1-2	Increasing of general interest rate	9: General rate of interest	No		default value: no evidence for application found
1-3	Decreasing of general interest rate	9: General rate of interest	No		default value: no evidence for application found
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No		default value: no evidence for application found
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No		default value: no evidence for application found
1-6	Asset purchases from markets	1: Asset demand	No		default value: no evidence for application found
1-7	Asset purchases from banks	19: Liquidity of banks	No		default value: no evidence for application found
1-8	Lightening of collateral requirements	24: Creditworthi-ness of banks	No		default value: no evidence for application found
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			Yes	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		summary
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	No		default value: no evidence for application found
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Laeven and Valencia (2008)	labelled as "nationalizations"
			Yes	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes		summary
3-2	Asset purchase programme	19: Liquidity of banks	No		default value: no evidence for application found
3-3	Asset programme	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008), Moe et al. (2004)	labelled as "asset management company"

#	Action	Element	Applied	Source	Comment
3-4	Debt moratoria for financed investors	18: Payments for loans	No		default value: no evidence for application found
3-5	Accounting discretion	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	3: Asset price	No		default value: no evidence for application found
3-8	Stress tests	25: Uncertainty	No		default value: no evidence for application found
3-9	Prohibition of short sales	21: Short sales	No		default value: no evidence for application found

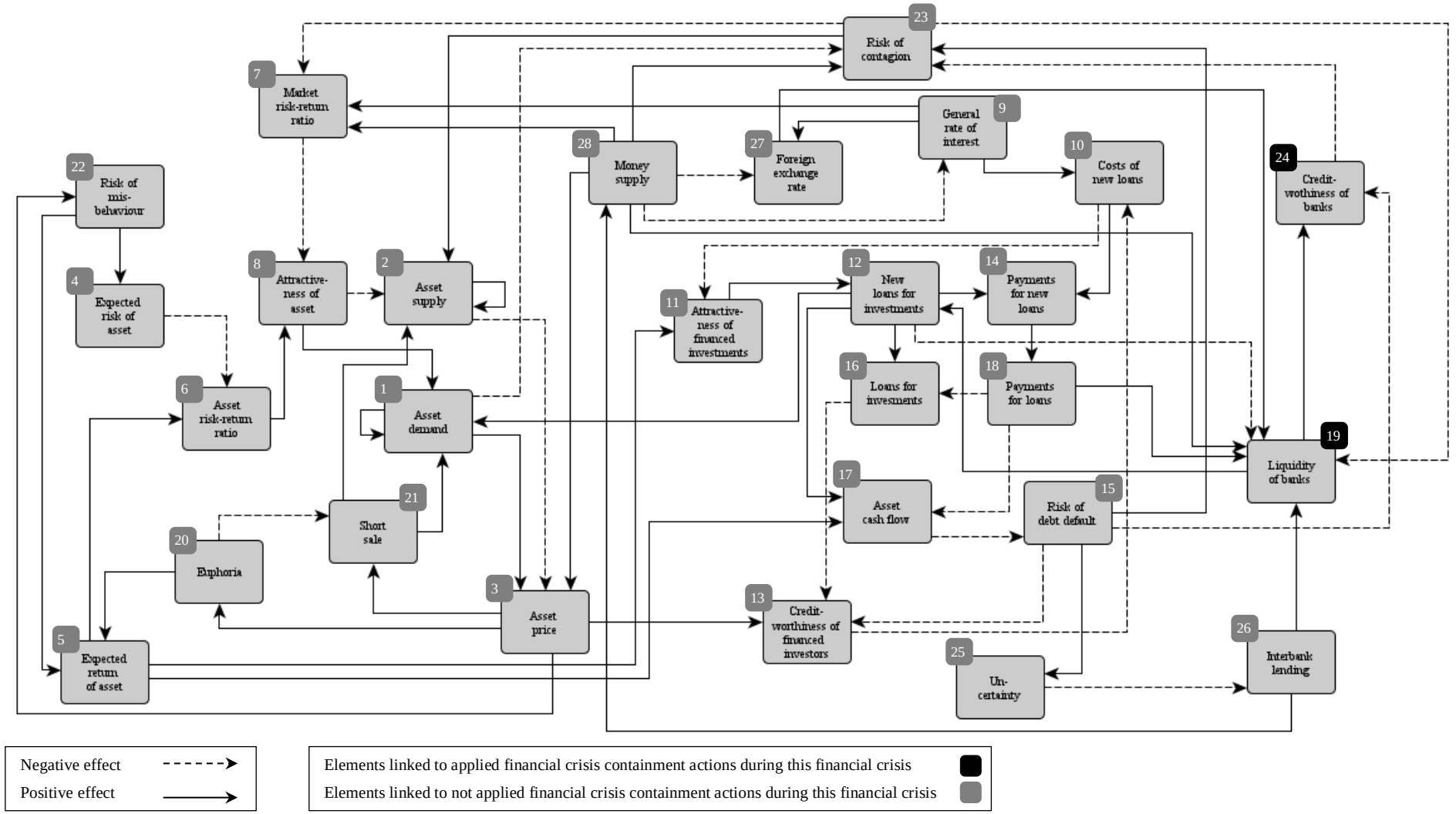


Figure 6-6: Containment actions in Norway 1991

According to the results of complex system approach four containment actions should be applied when domestic financial crises occur. Table 6-7 shows their application during the Norwegian financial crisis. None of these actions were applied.

Table 6-7: Applied recommended containment actions in Norway 1991

#	Action	Element	Applied
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-7	Bank holidays on exchanges	3: Asset price	No
3-9	Prohibition of short sales	21: Short sales	No

According to the results of complex system approach the majority of possible containment actions should not be applied in case of domestic financial crises. Table 6-8 shows their application during the Norwegian financial crisis. Three of these actions were applied. None of them are linked to active elements.

Table 6-8: Applied not-recommended containment actions in Norway 1991

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	No
1-2	Increasing of general interest rate	9: General rate of interest	No
1-3	Decreasing of general interest rate	9: General rate of interest	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No
1-6	Asset purchases from markets	1: Asset demand	No
1-7	Asset purchases from banks	19: Liquidity of banks	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	No
3-3	Asset transfer programme	24: Creditworthiness of banks	No
3-5	Accounting discretion	24: Creditworthiness of banks	Yes
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-8	Stress tests	25: Uncertainty	No

6.1.4 Financial crisis in Thailand 1997

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not-recommended actions.

The Thai financial crisis followed a prior phase of boom, which was initiated by foreign loans in combination with a pegged currency (Corsetti et al., 1999; Radelet and Sachs, 1998). The money were careless borrowed and the financial sector accumulated non-performing loans (Lauridsen, 1998).

The crisis started in July 1997 (Laeven and Valencia, 2008). The Thai stock market index SET reflects the Thai equity market and consists all traded securities on the stock exchange of Thailand (Stock Exchange of Thailand, 2014). This index started its down-turn already on February 7th 1996. The index lost 47% of its value within twelve months after the start of the down-turn (minimum value on February 5th 1997), which complies with the definition of Baro and Ursúa (2009) who define a financial crisis as a price drop of more than 25 per cent per year. The index regained the pre-crisis level after 6,176 days on January 4th 2013. Figure 6-7 shows the development of the index during the crisis (Data downloaded from http://www.wsj.com).

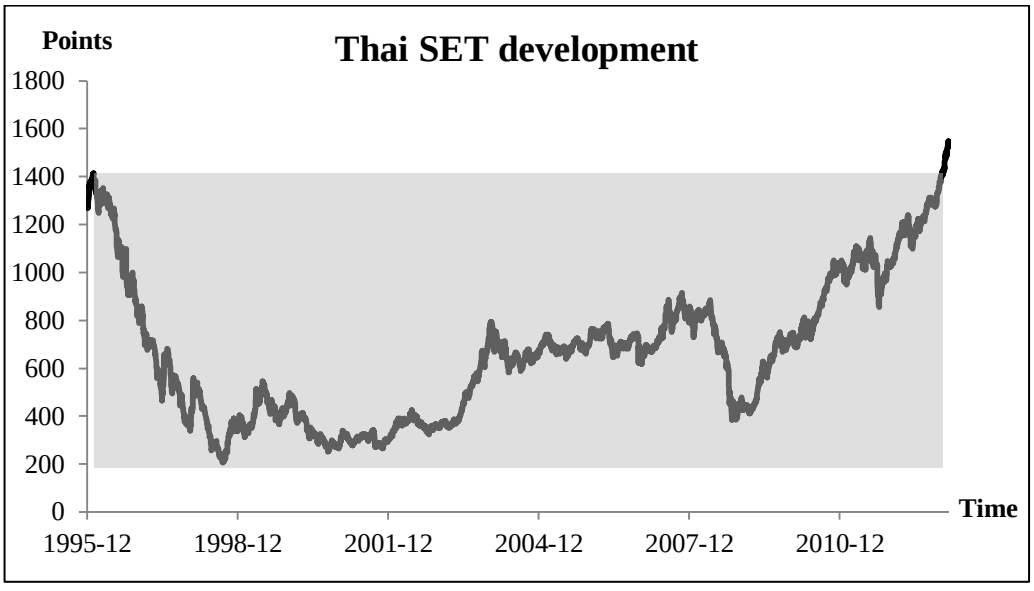


Figure 6-7: Thai SET development

According to Laeven and Valencia (2008) there were bank closures. They mentioned that a currency crisis had not occurred. However, during the financial crisis, the value of the Thai currency fluctuated from a minimum of 22.75 for one U.S. Dollar (June 17th 1997) to a maximum of 56.10 for one U.S. Dollar (January 8th 1998). This devaluation of 147% within 12 months can be seen as a currency crash. The fluctuation is higher than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-8 shows the Thai Baht development (Data downloaded from http://www.stlouisfed.org).

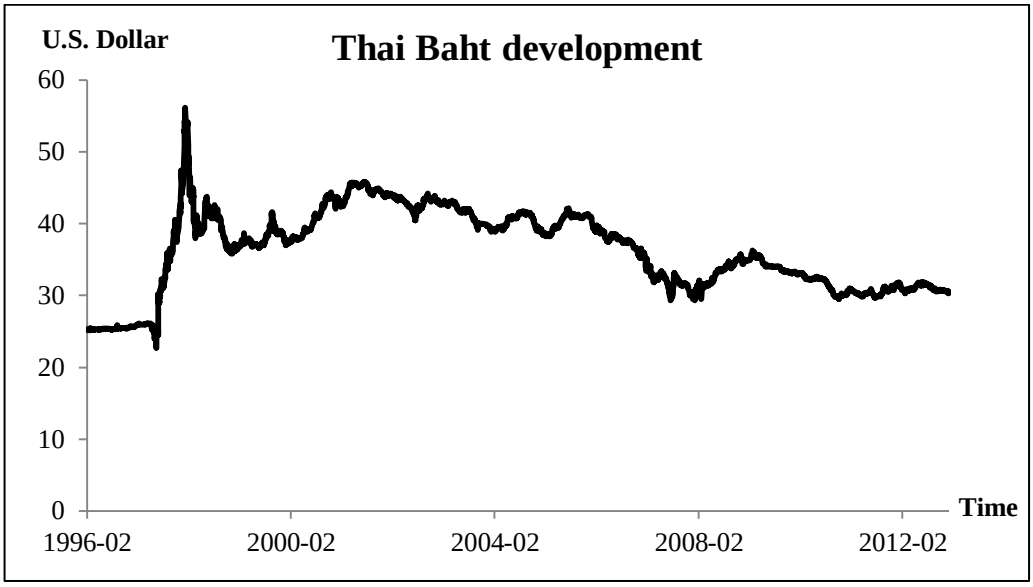


Figure 6-8: Thai Baht development

This Thai financial crisis can be classified as domestic. Economically leading countries were not affected.

Table 6-9: Facts of the financial crisis in Thailand 1997

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
Thailand	1997	Domestic	6,176	Yes	Yes

Table 6-10 shows the applied containment actions during the Thai financial crisis, including the source of information. Figure 6-9 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-10: Containment actions in Thailand 1997

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	No	Laeven and Valencia (2008)	
			Yes	Corsetti et al. (1999)	
			Yes		summary
1-2	Increasing of general interest rate	9: General rate of interest	No		default value: no evidence for application found
1-3	Decreasing of general interest rate	9: General rate of interest	Yes	Radelet and Sachs (1998), Corsetti (1999)	
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No		default value: no evidence for application found
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes	Corsetti (1999)	
1-6	Asset purchases from markets	1: Asset demand	No		default value: no evidence for application found
1-7	Asset purchases from banks	19: Liquidity of banks	No		default value: no evidence for application found
1-8	Lightening of collateral requirements	24: Creditworthi-ness of banks	No		default value: no evidence for application found
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			Yes	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		summary
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	No		default value: no evidence for application found
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Laeven and Valencia (2008)	labelled as "nationalizations"
			No	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes	Demirgüç-Kunt et al. (2015)	deposit insurance
			Yes		summary

#	Action	Element	Applied	Source	Comment
3-2	Asset purchase programme	19: Liquidity of banks	No		default value: no evidence for application found
3-3	Asset programme	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "asset management company"
3-4	Debt moratoria for financed investors	18: Payments for loans	No		default value: no evidence for application found
3-5	Accounting discretion	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	3: Asset price	No		default value: no evidence for application found
3-8	Stress tests	25: Uncertainty	No		default value: no evidence for application found
3-9	Prohibition of short sales	21: Short sales	No		default value: no evidence for application found

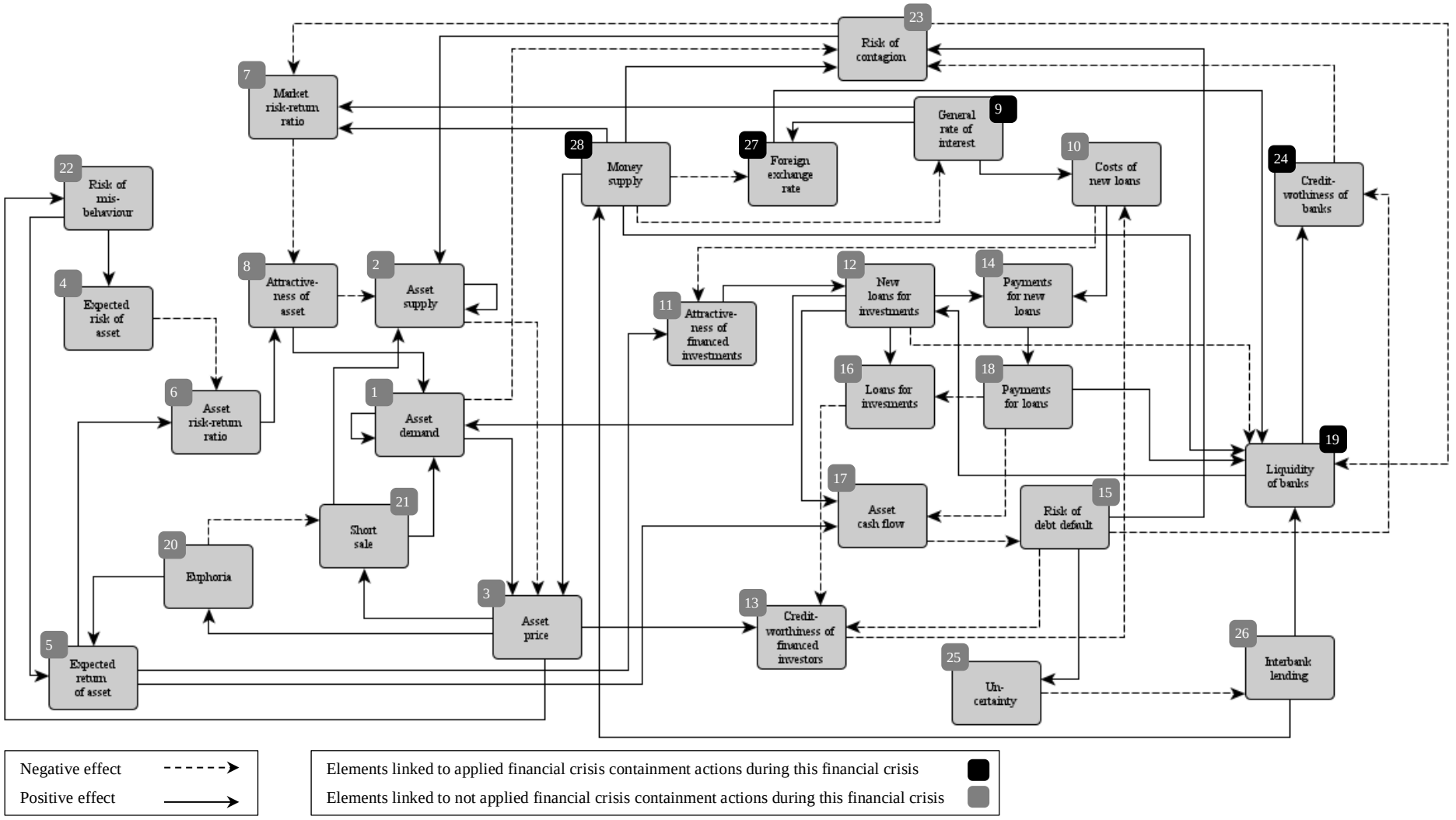


Figure 6-9: Containment actions in Thailand 1997

According to the results of complex system approach four containment actions should be applied when domestic financial crises occur. Table 6-11 shows their application during the Thai financial crisis. None of these actions were applied.

Table 6-11: Applied recommended containment actions in Thailand 1997

#	Action	Element	Applied
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-7	Bank holidays on exchanges	3: Asset price	No
3-9	Prohibition of short sales	21: Short sales	No

According to the results of complex system approach the majority of possible containment actions should not be applied in case of domestic financial crises. Table 6-12 shows their application during the Thai financial crisis. Seven of these actions were applied. Two of them are linked to active elements (actions [#1-1], [#1-3]).

Table 6-12: Applied not-recommended containment actions in Thailand 1997

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	Yes
1-2	Increasing of general interest rate	9: General rate of interest	No
1-3	Decreasing of general interest rate	9: General rate of interest	Yes
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes
1-6	Asset purchases from markets	1: Asset demand	No
1-7	Asset purchases from banks	19: Liquidity of banks	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	No
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes
3-4	Accounting discretion	24: Creditworthiness of banks	Yes
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-8	Stress tests	25: Uncertainty	No

6.1.5 Financial crisis in Russia 1998

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not-recommended actions.

The Russian financial crisis was caused by inherited weaknesses of the Russian fiscal policy, the drop of the oil price and the contagion effects of the Asian financial crisis (Desai, 2000; Popov, 2000).

The crisis started in August 1998 (Laeven and Valencia, 2008). The Russian stock market index RTS reflects the Russian equity market and comprises the 50 most liquid Russian stocks on the Moscow Exchange (Moscow Exchange, 2013). This index had dropped already on January 8th 1998 by about 6.8%, conforming to the definition of Vines (2003) who says price drops of more than five percent a day can be seen as an unusual event. The index regained the pre-crisis level after 1,590 days on May 17th 2002. Figure 6-10 shows the development of the index during the crisis (Data downloaded from http://www.yahoo.com).

Figure 6-10: Russian RTS development

According to Laeven and Valencia (2008) there were closures of banks and a currency crisis occurred. During the financial crisis, the value of the Russian currency fluctuated

from a minimum of 59.72 for one U.S. Dollar (January 9th 1998) to a maximum of 312.55 for one U.S. Dollar (May 17th 2002). Even in September 1998 the currency exchange rate dropped to 208.25 for one U.S. Dollar. This devaluation of 249% within 12 months can be seen as a currency crash. The fluctuation is higher than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-11 shows the Russian Rubble development (Data downloaded http://www.cbr.ru).

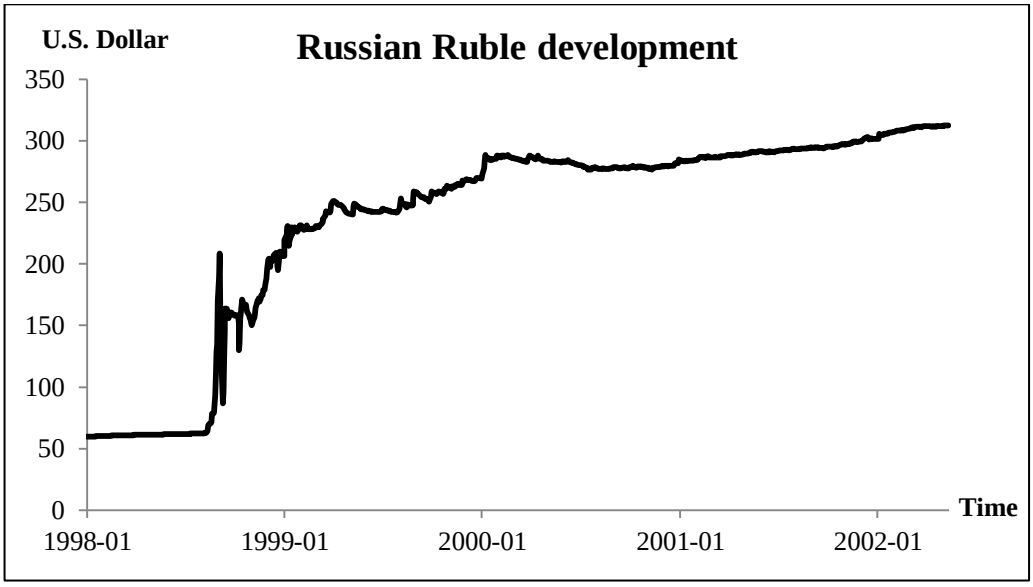


Figure 6-11: Russian Rubble development

This Russian financial crisis can be classified as domestic. Economically leading countries were not affected.

Table 6-13: Facts of the financial crisis in Russia 1998

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
Russia	1998	Domestic	1,590	Yes	Yes

Table 6-14 shows the applied containment actions during the Russian financial crisis, including the source of information. Figure 6-12 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-14: Containment actions in Russia 1998

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	Yes	Laeven and Valencia (2008), Popov (2000)	
1-2	Increasing of general interest rate	9: General rate of interest	Yes	Chiodo and Owyang (2002)	
1-3	Decreasing of general interest rate	9: General rate of interest	No		default value: no evidence for application found
1-4	Appreciation of domestic currency	27: Foreign exchange rate	Yes	Chiodo and Owyang (2002), Popov (2000)	
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes	Chiodo and Owyang (2002)	
1-6	Asset purchases from markets	1: Asset demand	No		default value: no evidence for application found
1-7	Asset purchases from banks	19: Liquidity of banks	No		default value: no evidence for application found
1-8	Lightening of collateral requirements	24: Creditworthi-ness of banks	No		default value: no evidence for application found
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			No	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		assumed information for this action
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	No		default value: no evidence for application found
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Laeven and Valencia (2008)	labelled as "nationalizations"
			No	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes		summary
3-2	Asset purchase programme	19: Liquidity of banks	No		default value: no evidence for application found
3-3	Asset transfer programme	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "asset management company"

#	Action	Element	Applied	Source	Comment
3-4	Debt moratoria for financed investors	18: Payments for loans	No	Chiodo and Owyang (2002), Popov (2000)	90-day moratorium only to foreign creditors
3-5	Accounting discretion	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	3: Asset price	Yes	Chiodo and Owyang (2002)	
3-8	Stress tests	25: Uncertainty	No		default value: no evidence for application found
3-9	Prohibition of short sales	21: Short sales	No		default value: no evidence for application found

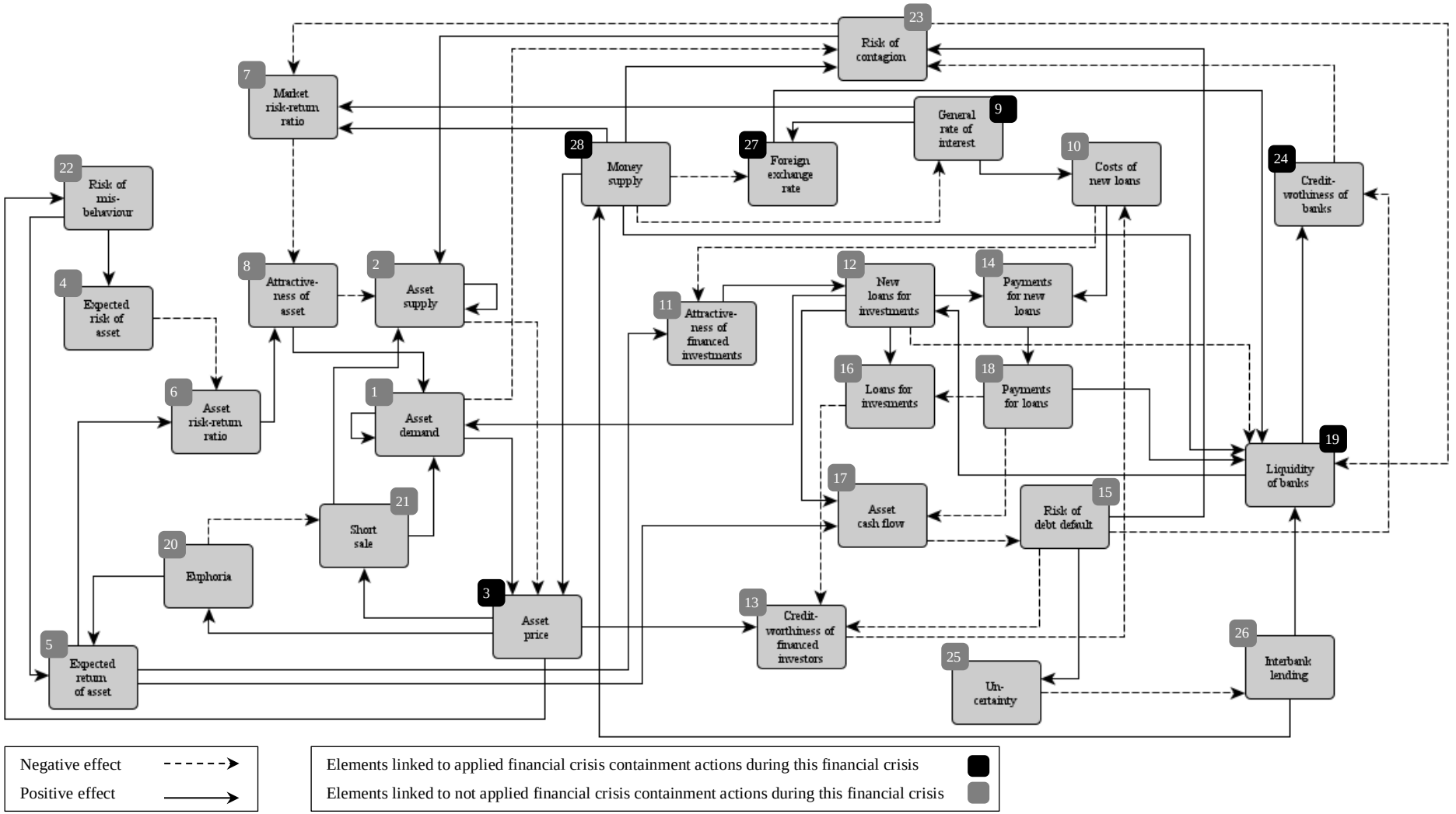


Figure 6-12: Containment actions in Russia 1998

According to the results of complex system approach four containment actions should be applied when domestic financial crises occur. Table 6-15 shows their application during the Russian financial crisis. Two of these actions were applied.

Table 6-15: Applied recommended containment actions in Russia 1998

#	Action	Element	Applied
1-4	Appreciation of domestic currency	27: Foreign exchange rate	Yes
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-7	Bank holidays on exchanges	3: Asset price	Yes
3-9	Prohibition of short sales	21: Short sales	No

According to the results of complex system approach the majority of possible containment actions should not be applied in case of domestic financial crises. Table 6-16 shows their application during the Russian financial crisis. Seven of these actions were applied. Two of them are linked to active elements (actions [#1-1], [#1-3]).

Table 6-16: Applied not-recommended containment actions in Russia 1998

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	Yes
1-2	Increasing of general interest rate	9: General rate of interest	Yes
1-3	Decreasing of general interest rate	9: General rate of interest	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes
1-6	Asset purchases from markets	1: Asset demand	No
1-7	Asset purchases from banks	19: Liquidity of banks	No
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	No
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	No
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes
3-5	Accounting discretion	24: Creditworthiness of banks	Yes
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-8	Stress tests	25: Uncertainty	No

6.1.6 Financial crisis in UK 2008

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not-recommended actions.

The financial crisis of 2008 was caused by too many granted loans based on too optimistic risk assessments (Financial Crisis Inquiry Commission, 2011).

The crisis started in August 2007 (Laeven and Valencia, 2008). The stock market index FTSE 100 reflects the UK equity market and comprises the 100 most highly capitalised companies listed on London Stock Exchange (FTSE Group, 2014). This index started its down-turn not before September 15th 2008. Even the Financial Crisis Inquiry Commission (2011) chose this date as the start of the crisis. The index lost more than 35% of its value within twelve months after the start of the downturn (minimum value on March 12th 2009), conforming to the definition of Baro and Ursúa (2009) who define a financial crisis as a price drop of more than 25 per cent per year. The index regained the pre-crisis level after 470 days on December 29th 2009. Figure 6-13 shows the development of the index during the crisis (Data downloaded from http://www.yahoo.com).

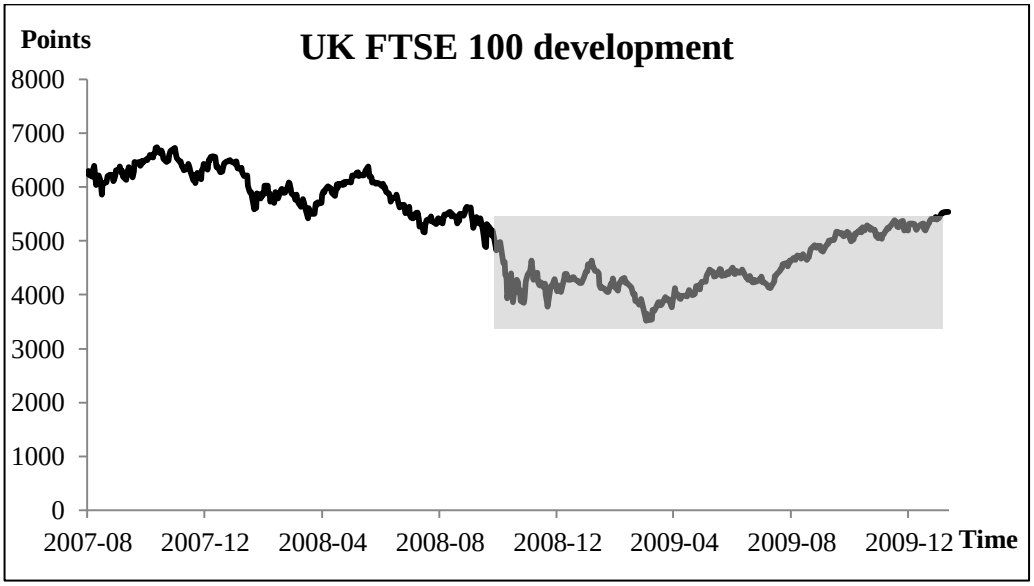


Figure 6-13: UK FTSE development

According to Laeven and Valencia (2008) there were neither closures of banks nor a currency crisis occurred. Banks with liquidity problems were support by various cations listed in this section. During the financial crisis, the value of the British currency fluctuated from a minimum of 1.3658 U.S. Dollar for one British Pound (January 23rd 2009) to a maximum of 1.8558 U.S. Dollar for one British Pound (September 23rd 2008). This devaluation of 26% within 12 months cannot be seen as a currency crash. The fluctuation is lower than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-14 shows the British Pound development (Data downloaded from http://www.stlouisfed.org).

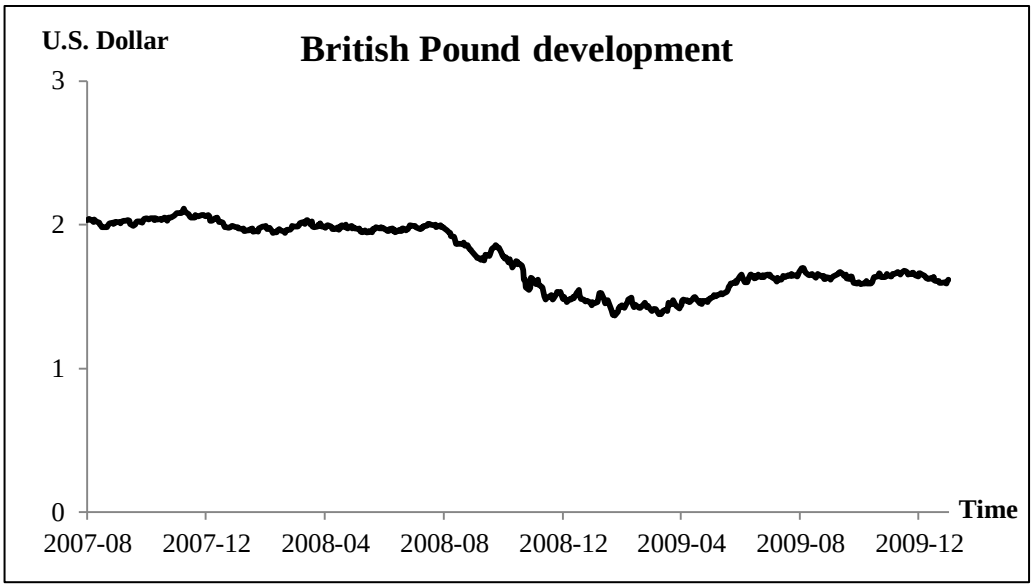


Figure 6-14: British Pound development

This English financial crisis can be classified as international. Economically leading countries were affected.

Table 6-17: Facts of the financial crisis in UK 2008

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
UK	2008	International	470	No	No

Table 6-18 shows the applied containment actions during the financial crisis in UK, including the source of information. Figure 6-15 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-18: Containment actions in UK 2008

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	Yes	Laeven and Valencia (2008)	
1-2	Increasing of general interest rate	9: General rate of interest	No	Bank of England (2014)	
1-3	Decreasing of general interest rate	9: General rate of interest	Yes	Bank of England (2014)	
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No	Claessens et al. (2011)	
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No	Claessens et al. (2011)	
1-6	Asset purchases from markets	1: Asset demand	Yes	Claessens et al. (2011)	labelled as "significant asset purchases"
1-7	Asset purchases from banks	19: Liquidity of banks	Yes	Laeven and Valencia (2010)	labelled as "significant asset purchases"
1-8	Lightening of collateral requirements	24: Creditworthi-ness of banks	Yes	Singh (2011)	
2-1	Provision of liquidity to banks	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			Yes	Laeven and Valencia (2012)	labelled as "extensive liquidity support "
			Yes	Claessens et al. (2011)	
			Yes	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		summary
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	Yes	Goldberg et al. (2011)	
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Claessens et al. (2011)	labelled as "significant guarantees"
			Yes	Laeven and Valencia (2008)	labelled as "nationalizations"
			Yes	Claessens et al. (2011)	labelled as "significant nationalizations"
			Yes	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes		summary

#	Action	Element	Applied	Source	Comment
3-2	Asset purchase programme	19: Liquidity of banks	Yes	Laeven and Valencia (2012)	labelled as “significant asset purchases”
3-3	Asset transfer programme	24: Creditworthi-ness of banks	Yes	Aït-Sahalia et al. (2010)	
3-4	Debt moratoria for financed investors	18: Payments for loans	No		default value: no evidence for application found
3-5	Accounting discretion	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	3: Asset price	No		default value: no evidence for application found
3-8	Stress tests	25: Uncertainty	Yes	Bank of England (2013)	
3-9	Prohibition of short sales	21: Short sales	Yes	McMillan and Philip (2012), Frino et al. (2011)	

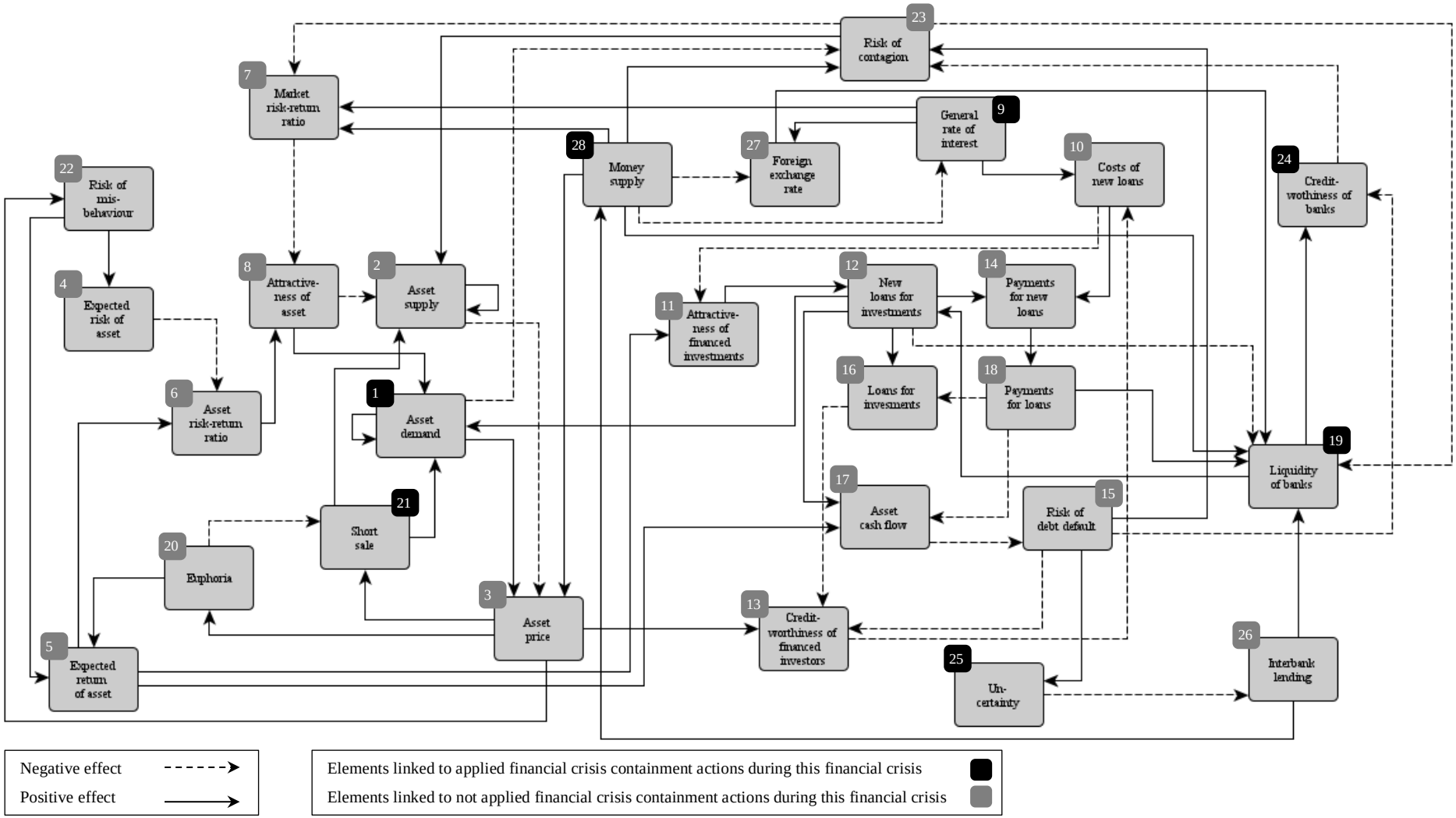


Figure 6-15: Containment actions in UK 2008

According to the results of complex system approach 13 containment actions should be applied when international financial crises occur. Table 6-19 shows their application during the financial crisis in UK. Eight of these actions were applied.

Table 6-19: Applied recommended containment actions in UK 2008

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	Yes
1-3	Decreasing of general interest rate	9: General rate of interest	Yes
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No
1-7	Asset purchases from banks	19: Liquidity of banks	Yes
2-1	Provision of liquidity	19: Liquidity of banks	Yes
2-2	Provision of liquidity	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	Yes
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-7	Bank holidays on exchanges	3: Asset price	No
3-8	Stress tests	25: Uncertainty	Yes
3-9	Prohibition of short sales	21: Short sales	Yes

According to the results of complex system approach only a few of possible containment actions should not be applied in case of international financial crises. Table 6-20 shows their application during the financial crisis in UK. Four of these actions were applied.

Table 6-20: Applied not-recommended containment actions in UK 2008

#	Action	Element	Applied
1-2	Increasing of general interest rate	9: General rate of interest	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No
1-6	Asset purchases from markets	1: Asset demand	Yes
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	Yes
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes
3-5	Accounting discretion	24: Creditworthiness of banks	No

6.1.7 Financial crisis in USA 2008

This section contains information about the background of the crisis, key facts about the indicators of the successful handling of the crisis, applied containment actions, including the sources of information and a derived overview of applied recommended and not-recommended actions.

The financial crisis of 2008 was caused by too many granted loans based on too optimistic risk assessments (Financial Crisis Inquiry Commission, 2011).

The U.S. financial crisis started in August 2007 (Laeven and Valencia, 2008). The U.S. stock market index Dow Jones Industrial Average reflects the U.S. equity market and comprises the 30 companies listed on New York Stock Exchange (S&P Dow Jones Indices, 2014). This index started its down-turn not before September 15th 2008. Even the Financial Crisis Inquiry Commission (2011) chose this date as the start of the crisis. The index lost more than 42% of its value within twelve months after the start of the downturn (minimum value on March 9th 2009), which complies with the definition of Baro and Ursúa (2009) who define a financial crisis as a price drop of more than 25 per cent per year. The index regained the pre-crisis level after 780 days on November 4th 2010. Figure 6-16 shows the development of the index during the crisis (Data downloaded from http://www.stlouisfed.org).

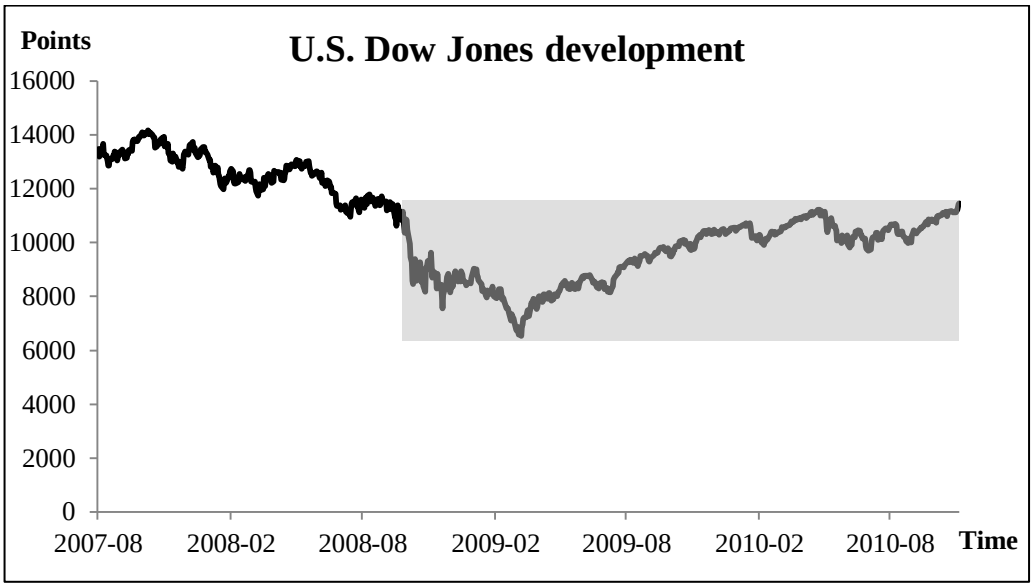


Figure 6-16: U.S. Dow Jones development

According to Laeven and Valencia (2008) there were neither closures of banks nor a currency crisis occurred. However, after their publication the bank Lehman Brothers was closed (Financial Crisis Inquiry Commission, 2011). During the financial crisis, the value of the U.S. currency fluctuated from a minimum of 1.1959 U.S. Dollar for one Euro (June 7th 2010) to a maximum of 1.5100 U.S. Dollar for one Euro (January 12th 2009). This fluctuation of 26% cannot be seen as a currency crash. The fluctuation is lower than the threshold of 30% as defined by Laeven and Valencia (2008) who basically used the approach of Frankel and Rose (1996). Figure 6-17 shows the U.S. Dollar development (Data downloaded from http://www.stlouisfed.org).

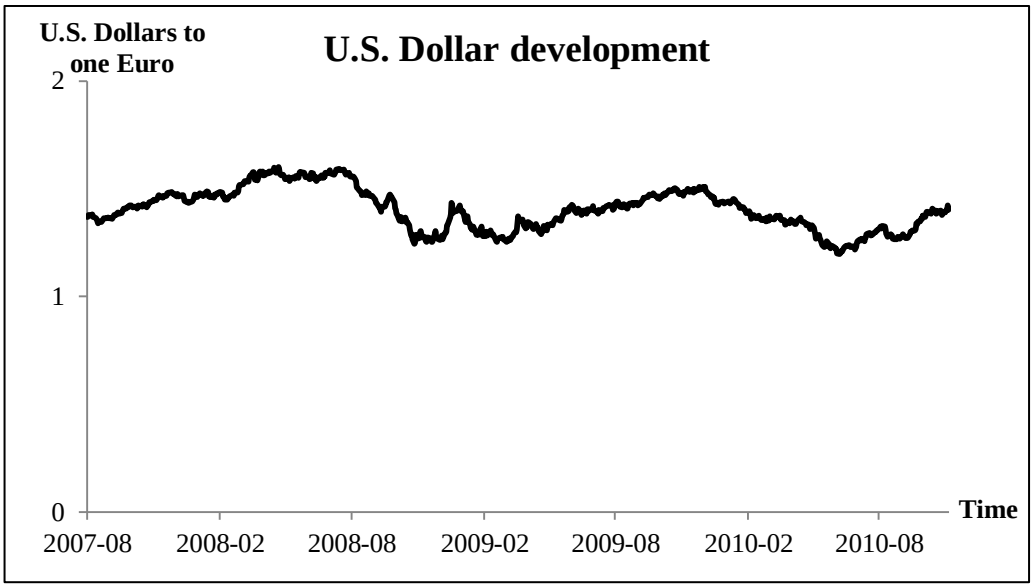


Figure 6-17: U.S. Dollar development

This U.S. financial crisis can be classified as international. Economically leading countries were affected.

Table 6-21: Facts of the financial crisis in USA 2008

Country	Year	Scope	Duration of asset price recovery	Bank closures	Currency crisis
USA	2008	International	780	Yes	No

Table 6-22 shows the applied containment actions during the U.S. financial crisis, including the source of information. Figure 6-18 visualises the applied containment actions within the systemic financial crisis model (in dark grey).

Table 6-22: Containment actions in USA 2008

#	Action	Element	Applied	Source	Comment
1-1	Extension of money supply	28: Money supply	Yes	Claessens et al. (2011)	
1-2	Increasing of general interest rate	9: General rate of interest	No	Claessens et al. (2011)	
1-3	Decreasing of general interest rate	9: General rate of interest	Yes	Claessens et al. (2011)	
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No	Claessens et al. (2011)	
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No	Claessens et al. (2011)	
1-6	Asset purchases from markets	1: Asset demand	Yes	Claessens et al. (2011)	labelled as "significant asset purchases"
1-7	Asset purchases from banks	19: Liquidity of banks	Yes	Stone et al. (2011)	
1-8	Lightening of collateral requirements	24: Creditworthi-ness of banks	Yes	Claessens et al. (2011)	
2-1	Provision of liquidity to banks	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "liquidity support/emergency lending"
			Yes	Laeven and Valencia (2012)	labelled as "extensive liquidity support "
			Yes	Claessens et al. (2011)	labelled as "extensive liquidity support"
			Yes	Laeven and Valencia (2008)	labelled as "recapitalization"
			Yes		summary
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No		default value: no evidence for application found
2-3	Provision of foreign liquidity	19: Liquidity of banks	Yes	Goldberg et al. (2011)	
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "blanket guarantee"
			Yes	Claessens et al. (2011)	labelled as "significant guarantees"
			No	Laeven and Valencia (2008)	labelled as "nationalizations"
			Yes	Claessens et al. (2011)	labelled as "significant nationalizations"
			Yes	Laeven and Valencia (2008)	labelled as "deposit insurance"
			Yes		summary

#	Action	Element	Applied	Source	Comment
3-2	Asset purchase programme	19: Liquidity of banks	Yes	Laeven and Valencia (2012)	labelled as "significant asset purchases"
3-3	Asset transfer programme	24: Creditworthi-ness of banks	Yes	Laeven and Valencia (2008)	labelled as "asset management company"
3-4	Debt moratoria for financed investors	18: Payments for loans	No		default value: no evidence for application found
3-5	Accounting discretion	24: Creditworthi-ness of banks	No	Laeven and Valencia (2008)	labelled as "forbearance"
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	Laeven and Valencia (2008)	labelled as "deposit freeze"
			No	Laeven and Valencia (2008)	labelled as "bank holiday"
			No		summary
3-7	Bank holidays on exchanges	3: Asset price	No	Colesanti (2010)	
3-8	Stress tests	25: Uncertainty	Yes	Pritsker (2012)	
3-9	Prohibition of short sales	21: Short sales	Yes	McMillan and Philip (2012) and Frino et al.	

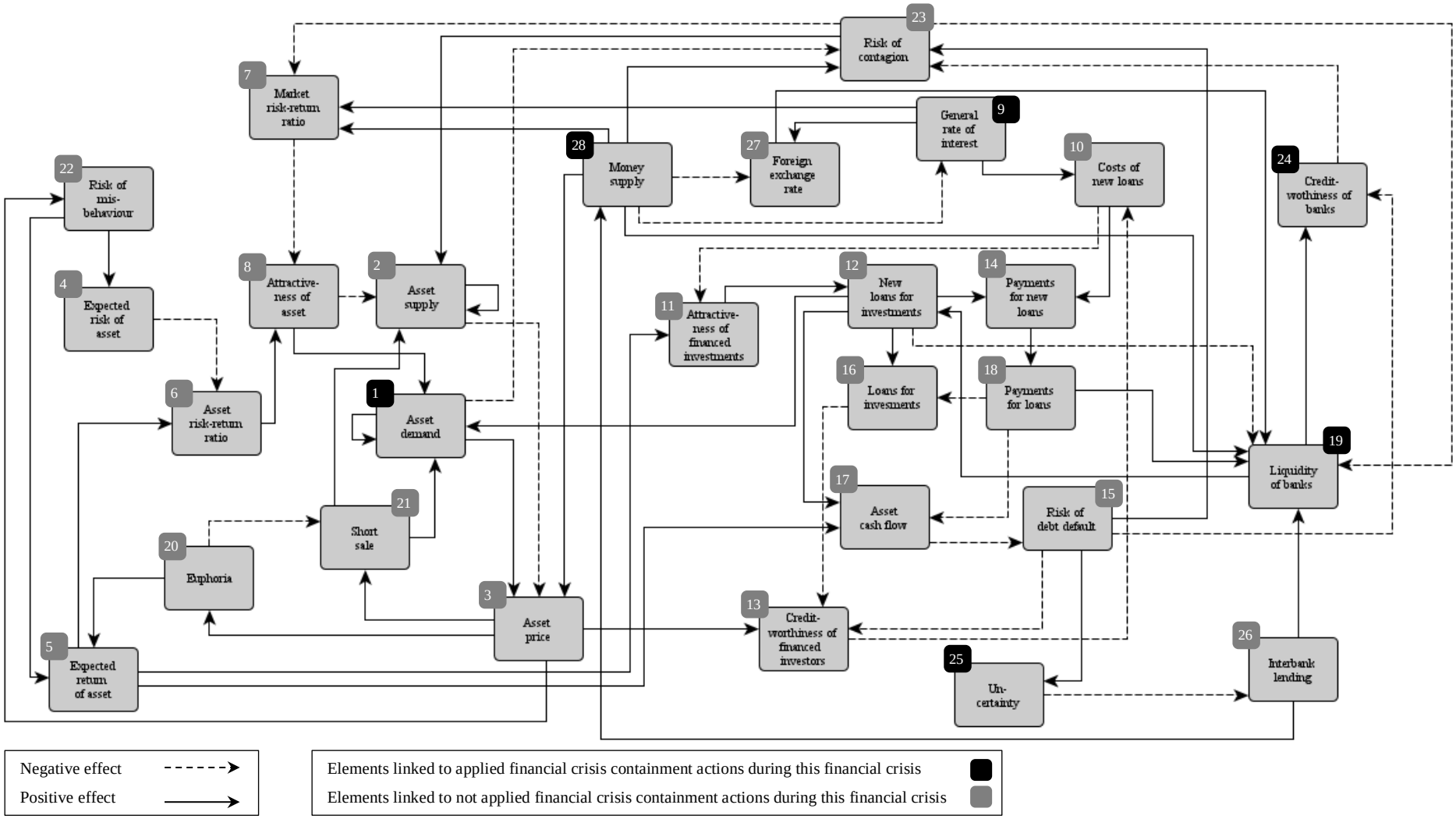


Figure 6-18: Containment actions in USA 2008

According to the results of complex system approach 13 containment actions should be applied when international financial crises occur. Table 6-23 shows their application during the U.S. financial crisis. Eight of these actions were applied.

Table 6-23: Applied recommended containment actions in USA 2008

#	Action	Element	Applied
1-1	Extension of money supply	28: Money supply	Yes
1-3	Decreasing of general interest rate	9: General rate of interest	Yes
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No
1-7	Asset purchases from banks	19: Liquidity of banks	Yes
2-1	Provision of liquidity	19: Liquidity of banks	Yes
2-2	Provision of liquidity	17: Asset cash flow	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	Yes
3-2	Asset purchase programme	19: Liquidity of banks	Yes
3-4	Debt moratoria for financed investors	18: Payments for loans	No
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No
3-7	Bank holidays on exchanges	3: Asset price	No
3-8	Stress tests	25: Uncertainty	Yes
3-9	Prohibition of short sales	21: Short sales	Yes

According to the results of complex system approach only a few of possible containment actions should not be applied in case of international financial crises. Table 6-24 shows their application during the U.S. financial crisis. Four of these actions were applied.

Table 6-24: Applied not-recommended containment actions in USA 2008

#	Action	Element	Applied
1-2	Increasing of general interest rate	9: General rate of interest	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	No
1-6	Asset purchases from markets	1: Asset demand	Yes
1-8	Lightening of collateral requirements	24: Creditworthiness of banks	Yes
3-1	Deposit insurance, guarantees and nationalisation	24: Creditworthiness of banks	Yes
3-3	Asset transfer programme	24: Creditworthiness of banks	Yes
3-5	Accounting discretion	24: Creditworthiness of banks	No

The last pages showed which of the recommended and not-recommended containment actions were applied during different financial crises and how successfully the crises were handled based on three criteria corresponding to the key elements of the system. The next section consolidates that information, allowing an evaluation of the results of the complex system approach.

6.2 Evaluation of historical information

This section contains the aggregated information of historical financial crises and their evaluation detailed on the previous pages. The rationale of this deductive approach is outlined in Chapter 3.4. This section starts with a summary of applied and not-applied actions for each crisis. The second overview shows an aggregated view on the application of recommended and not-recommended actions for each financial crisis and the third overview combines the facts about containment actions during financial crises, the collected indicators for asset price recovery, bank closures and occurred currency crises, allowing a qualitative evaluation.

Aggregated information of historical financial crises

Table 6-25 gives a summary of actions applied during the studied crises. Four actions were more frequently applied during considered financial crises. The actions “Provision of liquidity to banks” [#2.1] and “Deposit insurance, guarantees and nationalisation” [#3.1] were always applied and the actions “Extension of money supply” [#1.1] and “Asset transfer programme” [#3.3] were nearly almost applied. The actions “Provision of liquidity to financed investors” [#2.2], “Debt moratoria for financed investors” [#3.4] and “Deposit freezing or bank holidays” [#3.6] were not applied and the application of the actions “Appreciation of domestic currency” [#1.4] and “Bank holidays on exchanges” [#3.7] were unfamiliar.

Table 6-25: Summary of historical information of financial crises

#	Action	Element	Sweden 1991	Norway 1991	Thailand 1997	Russia 1998	UK 2008	USA 2008
1-1	Extension of money supply	28: Money supply	Yes	No	Yes	Yes	Yes	Yes
1-2	Increasing of general interest rate	9: General rate of interest	Yes	No	No	Yes	No	No
1-3	Decreasing of general interest rate	9: General rate of interest	No	No	Yes	No	Yes	Yes
1-4	Appreciation of domestic currency	27: Foreign exchange rate	No	No	No	Yes	No	No
1-5	Depreciation of domestic currency	27: Foreign exchange rate	Yes	No	Yes	Yes	No	No
1-6	Asset purchases from markets	1: Asset demand	No	No	No	No	Yes	Yes
1-7	Asset purchases from banks	19: Liquidity of banks	No	No	No	No	Yes	Yes
1-8	Lightening of collateral requirements	24: Credit-worthiness of banks	No	No	No	No	Yes	Yes
2-1	Provision of liquidity to banks	19: Liquidity of banks	Yes	Yes	Yes	Yes	Yes	Yes
2-2	Provision of liquidity to financed investors	17: Asset cash flow	No	No	No	No	No	No
2-3	Provision of foreign liquidity	19: Liquidity of banks	No	No	No	No	Yes	Yes
3-1	Deposit insurance, guarantees and nationalisation	24: Credit-worthiness of banks	Yes	Yes	Yes	Yes	Yes	Yes
3-2	Asset purchase programme	19: Liquidity of banks	No	No	No	No	Yes	Yes
3-3	Asset transfer programme	24: Credit-worthiness of banks	Yes	No	Yes	Yes	Yes	Yes
3-4	Debt moratoria for financed investors	18: Payments for loans	No	No	No	No	No	No
3-5	Accounting discretion	24: Credit-worthiness of banks	No	Yes	Yes	Yes	No	No
3-6	Deposit freezing or bank holidays	19: Liquidity of banks	No	No	No	No	No	No
3-7	Bank holidays on exchanges	3: Asset price	No	No	No	Yes	No	No
3-8	Stress tests	25: Uncertainty	No	No	No	No	Yes	Yes
3-9	Prohibition of short sales	21: Short sales	No	No	No	No	Yes	Yes

Table 6-26 shows an aggregated view on the application of recommended and not-recommended actions for each financial crisis. In general, not all domestic financial crises

applied exclusively recommended actions ("does"). Only Russia intervened with two effective actions. In fact, Sweden, Norway and Thailand did not apply any of them. Instead, not-recommended actions ("don'ts") were broadly applied. Norway applied to a lesser extent not-recommended actions. International crises can be differently handled. The international financial crisis of 2008 showed that a broad range of recommended actions and only a few of the not-recommended actions were applied.

Table 6-26: Aggregated historical information of financial crises

Country	Year	Scope	# does	# don'ts
Sweden	1991	Domestic	0	6
Norway	1991	Domestic	0	3
Thailand	1997	Domestic	0	7
Russia	1998	Domestic	2	7
UK	2008	International	8	4
USA	2008	International	8	4

Evaluation

The evaluation is based on a matching of the results of the complex system approach (see Chapter 5) with collected historical information. Table 6-27 summarises the facts of containment actions during financial crises and combines them with the collected evaluation criteria (asset price recovery, bank closures and occurred currency crises). Just domestic financial crises can be evaluated. Both international financial crises are characterised by identically applied containment actions. Therefore, they cannot be cannot be matched and evaluated.

Table 6-27: Evaluation of financial crisis actions

Country	Year	Scope	# does	# does (active)	# don'ts	# don'ts (active)	Duration of asset price recovery	Bank closures	Currency crisis
Sweden	1991	Domestic	0	0	6	2	625	No	Yes
Norway	1991	Domestic	0	0	3	0	844	Yes	No
Thailand	1997	Domestic	0	0	7	2	6,176	Yes	Yes
Russia	1998	Domestic	2	0	7	2	1,590	Yes	Yes
UK	2008	International	8	2	4	0	470	No	No
USA	2008	International	8	2	4	0	780	Yes	No

The duration of asset price recovery fluctuates immensely between 625 days in Sweden and 6,176 days in Thailand. A common pattern cannot be identified for applied recommended actions. However, less applied not-recommended actions seem to result in shorter durations of an asset price recovery. Norway had the second shortest recovery for asset prices (844 days). Unlike the other countries, they did apply only three not-recommended actions and they cannot be categorised as active and, therefore, powerful actions. The mean for all other domestic crises is 2,797 days and they applied significantly more not-recommended-actions (six or more).

Bank closures happened during financial crises. A common pattern, however, can neither be identified for applied recommended actions nor for applied not-recommended actions.

All domestic financial crises but Norway faced currency crises. A common pattern cannot be identified for applied recommended actions. However, more applied not-recommended actions seem to be linked to currency crises. Unlike other countries, Norway did apply only three not-recommended actions and they were not categorised as active. All other domestic crises applied significantly more not-recommended actions (six or more) and all of them had to face a currency crises.

The historical analysis, in part, strengthens the results of the complex system approach. Less applied not-recommended actions seem to result in shorter durations of asset price recovery and seem to cause less of likely currency crises. However, the limited information does not allow extended statistical analysis or a falsification. A greater number of crises would be required. At the moment, it cannot be said that the positive effects on the indicators are caused by the applied actions. Other factors, too, may have influenced the indicators.

This sixth chapter showed all gathered information about the second phase of this research. The approach, the collected data, their sources and the outcome of the historical evaluation were dealt with. The next chapter consolidates the outcomes of chapters five and six, compares them with other research and shows the contribution of this research.

7 Conclusions, discussion and policy contributions

This chapter consolidates the outcomes of the systemic analysis of financial crisis containment actions (see Chapter 5) and their historical evaluation (see Chapter 6) and compares them with findings of other research. In addition, the contributions to knowledge and general patterns of the outcome are identified and the potential of further research are outlined.

Chapter 7.1 shows the outcome of the assessment of containment actions and differentiates the actions of involved institutions (i.e. central banks, lenders of last resort and governments and regulators). In addition, the outcome of promising new actions and the results of the analysis of interferences are concluded. All outcomes are compared with other relevant research.

Chapter 7.2 highlights the policy contributions and appraises the outcomes of this research. Three remarkable patterns could be identified. In addition, further research is suggested.

7.1 Conclusions and discussion of results

This section shows the conclusions for effective financial crisis containment actions.

Chapters 7.1.1, 7.1.2 and 7.1.3 contain the identified actions of central banks, lenders of last resort and governments and regulators. The sequence of actions corresponds to the numbering of Chapter 4.5. Relevant research questions are repeated and relevant sections of this thesis are cross-referenced.

Chapter 7.1.4 shows the conclusions for potential new actions and Chapter 7.1.5 concludes and discusses interferences.

7.1.1 Effectiveness of central banks' crisis containment actions

The first research question asks: How effective are the crisis containment actions of central banks?

The containment actions of central banks are listed in Chapters 2.3 and 4.5.1. The analysis results are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1.

The results of the analysis suggest that central banks do not have an ultimate containment action that can be seen as sustainable, powerful and leading to exclusively positive effects.

The appreciation of the domestic currency improves the liquidity of banks and strengthens the foreign exchange rate. However, it cannot be seen as a sustainable action. In general, only the extension of money supply and the adjustment of the general rate of interest are strong enough to change the system's behaviour, which complies with Belongia and Ireland (2014). Asset prices might be pushed by the extension of money supply, purchases of assets from markets and the decreasing of the general rate of interest. All actions but the increasing of the general rate of interest, asset purchases from markets and the depreciation of foreign exchange rate improve the liquidity of banks. The majority of actions dilute the foreign exchange rate. Only an increase of the interest rate, direct foreign exchange interventions and an increase of the asset demand might appreciate the domestic currency.

Extension of money supply

This research shows that the extension of money supply is a powerful action, which is capable of changing the system's behaviour. Asset prices and the liquidity of banks slightly increase. However, the action is not sustainable meaning that for the same effect, the action needs to be applied again. The initial impulse is not automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, liquidity of banks and new loans for investments play important roles. The increased liquidity of banks is caused by the increased asset price increasing the expected return of non-fixed income assets, reducing the risk of contagion and raising the liquidity of banks. The historical evaluation of this research shows that almost all central banks increased the money supply when they faced financial crises.

These results are consistent with the argumentation of Mishkin (2009). He suggests that a tightened monetary policy initiates an economic downturn. A shortened money supply would make new loans cost more, which would, in the end, contract economic activities negatively impacting asset prices. This research shows that an extended money supply

decreases the general rate of interest and increases asset prices mainly through the effects on the risk of contagion. Theoretically however, in case of domestic financial crises, an extension of money supply can negatively impact the foreign exchange rate. He did not mention this aspect. But he described the last financial crisis in his article, which can be categorised as an international crisis. This aspect is not relevant if all central banks of important currencies harmonise their monetary policy.

The importance of an extension of money supply was highlighted by Friedman and Schwartz (2007). They argue that the US Federal Reserve tightened money supply during the financial crisis of 1929 had caused The Great Depression. The former head of the US central bank Bernanke (2002) stated "But thanks to you [Milton Friedman], we won't do it again".

In general, Borio (2014) argues that monetary policy should generally be less intensive in order to prevent future crises. However, even he emphasises that "it is natural to use monetary policy aggressively" during financial crisis in order to contain them.

The normal procedure of money creation is based on a relation between the central bank and other banks. An increase in money supply increases the liquidity of all banks. It does not specifically support any single bank. This complies with Laeven and Valencia (2011) who suggest that other actions are effective in supporting individual firms instead of monetary policy. However, this action, which can be classified as a lender of last resort action to individual parties, is dealt with in the next section.

Increasing or decreasing of general interest rate

This research shows that the adjustment of interest rates is a powerful action that is capable of changing the system's behaviour. A decreasing of the interest rate raises asset prices and the liquidity of banks but slightly decreases the foreign exchange rate. An increasing of the general rate of interest causes the opposite effects. Asset prices and the liquidity of banks decrease and the foreign exchange rate slightly increase. In addition, both actions can be seen as slightly sustainable. For the same effect, the actions do not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to the costs of new loans, asset prices,

the risk of contagion, money supply, interbank lending and the credit cash flow of financed investors play significant roles. Side-effects have to be considered. If the liquidity of banks is increased by a decreasing of the general rate of interest, loans for investments and the foreign exchange rate decrease but the creditworthiness of banks will go up. The foreign exchange rate could be increased by an increasing of the general rate of interest, which increases the market risk-return ratio and the attractiveness of assets would as well. In addition, new loans for investments, payments for new and existing loans would decrease. The historical evaluation shows that central banks increased and decreased interest rates when they faced a financial crisis.

The results comply with the analysis of Lahiri and Vegh (2003). They explain that higher interest rates attract foreign investors. However, higher costs of new loans are linked to this action, which could worsen the crisis. They summarise that the raising of interest rates could just buy time for reform measures.

Aït-Sahalia et al. (2010) show that interest rate cuts increase the creditworthiness of banks. The analysis of this effect was not in scope of this research. However, the creditworthiness of banks is directly influenced by the liquidity of banks which is in scope of this research and can be a basis for a comparison. A cut in interest rates leads to greater liquidity for banks. The main reason lies in rising asset prices that lead to greater financed investments and repayments of loans. The increased liquidity raises the creditworthiness of banks, which is in conformity to the results of their research. However, a second, directly related, element to the creditworthiness of banks dilute the effects. Higher risks of a debt default leads to a lower creditworthiness.

Bernanke et al. (2004) say that interest rates are capable of affecting asset prices. This is obvious for fixed income assets like bonds. Existing assets with a higher interest rate would be more attractive than new assets with a lower interest rate, which increases their price. In addition, this research shows that the asset price of non-fixed income assets too increases once the general rate of interest is reduced. The cut in interest rates decrease, on the one hand, the costs of financed investments and, on the other hand, the market risk-return ratio.

In times without financial crises, the adjustment of interest rates should follow a rational concept. The Taylor rule calculates the optimal rate of interest in response to inflation and output (Taylor, 1979; Taylor, 1993). However, it does not contain aspects of liquidity stress during financial crises. The rule suggests that central banks should control the price of goods for their assessment of inflation that influences their decision on the interest rates. However, financial assets are not considered as goods. It is assumed that asset prices are exclusively influenced by consumption of goods. Neither does it consider that higher asset values let people feel richer and might encourage more consumption nor that the opposite happens in case of decreased asset prices (Issing, 2009). Therefore, in extraordinary circumstances a different concept might be necessary.

Appreciation or depreciation of domestic currency

This research shows that the appreciation or depreciation of the foreign exchange rate is neither powerful nor sustainable meaning that for the same effect, the actions need to be applied again. The initial impulse is not automatically amplified in the long-term. An appreciation increases the foreign exchange rate directly and, indirectly, the liquidity of banks. Depreciation has the opposite effects. The foreign exchange rate and the liquidity of banks decrease, though asset prices are not significantly influenced. For the effects of these actions the direct and indirect interrelations to asset prices, the risk of contagion, liquidity of banks, the cash flow of financed investors and new loans for investments play important roles.

Side-effects have to be considered. An appreciation leads to less new loans for investments and less payments for new and existing loans while the market risk-return ratio and the attractiveness of assets increase. The historical evaluation shows that almost all domestic financial crises are linked with appreciation or depreciation.

The identified positive effects of appreciations seen in this research comply with Stone et al. (2011) who see large-scale foreign exchange interventions as an effective action for central banks.

Asset purchases from markets or banks

This research shows that asset purchases from markets or banks are no powerful actions and that lead to a slightly decrease of banks liquidity.

Nevertheless, asset purchases from markets have positive effects. They are sustainable and slightly increase asset prices and the foreign exchange rate. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, asset cash flow of financed investors, the money supply and new loans for investments play significant roles. Side-effects have to be considered. The application of this action increases the creditworthiness of banks. The foreign exchange rate could be raised by increasing asset purchases that leads to more new loans and an increased creditworthiness of financed investors. In addition, the costs of new loans and payments for new and existing loans raise as well.

Asset purchases from banks are slightly sustainable, increasing the liquidity of banks but letting the foreign exchange rate drop. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, new loans for investments, creditworthiness of banks, money supply and interbank lending play considerable roles. Side-effects have to be considered. An increase of the liquidity of banks increases the market risk-return ratio and the attractiveness of assets.

The historical evaluation shows that these kind of actions have been applied during the most recent financial crises.

The results of this research are conform with Bernanke et al. (2004), Garcia and Nieto (2013) and Roubini and Mihm (2011) suggesting that asset purchases boost the price of targeted assets. Asset prices for non-fixed income assets are slightly increased by purchases from markets. The effect is not as strong as expected. While the additional demand increases the asset price, the additional liquidity decreases the risk of contagion causing more loans for investments reducing the creditworthiness of financed investors,

resulting in more payments for loans. Both the decreased creditworthiness of financed investors and more payments for loans cause indirectly less money supply with its negative effects on asset prices.

The direct purchase from banks increases the liquidity of banks significantly, conforming to Stone et al. (2011) and Laeven and Valencia (2011) who observe that asset purchases are effective for central banks to provide liquidity to banks and to stabilise asset prices.

Lightening of collateral requirements

This research shows that the lightening of collateral requirements is not a powerful action but can be seen as slightly sustainable meaning that for the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. Only the liquidity of banks might be increased. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, money supply, interbank lending and the asset cash flow of financed investors play considerable roles. Side-effects have to be considered. An increase of the creditworthiness of banks increases the asset demand. If the liquidity of banks is increased by this action, the asset demand, the market risk-return ratio" and the attractiveness of assets increase as well. The historical evaluation shows that this action is a new instrument in the hand of central banks.

The results are in conformity to Ghosh et al. (2009) who argue that in times of crises the collateral framework should be extended in order to provide liquidity to banks.

Provision of loans is inherently linked to higher risks especially during financial crises. Goodfriend and King (1988) emphasise that those risks can be mitigated by high quality collateral, which would oppose this kind of action.

7.1.2 Effectiveness of lenders of last resort

The second research question asks: How effective are the containment efforts of the lenders of last resort? Three actions that can be differentiated are described in this section.

The containment actions are listed in Chapters 2.3 and 4.5.2. The analysis results are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1.

The results of the analysis suggest that the provision of (foreign) liquidity to banks and to financed investors are slightly sustainable but not powerful enough to change the system's behaviour. For the same effect, the actions do not need to be applied again. The initial impulse is automatically amplified in the long-term. The liquidity of banks is positively affected but the foreign exchange rate decreases. For these effects, the direct and indirect interrelations to asset prices, the risk of contagion, new loans for investments, creditworthiness of banks, money supply and interbank lending play important roles. Side-effects have to be considered. An increase of the liquidity of banks increases the market risk-return ratio and the attractiveness of assets.

Only the provision of liquidity of financed investors increases asset prices. For the effects of this action, the direct and indirect interrelations to asset prices, the risk of debt default, the asset cash flow of financed investors play considerable roles. Side-effects have to be considered. An increase of the liquidity of banks by this action increases the general rate of interest.

The historical evaluation shows that, in all analysed financial crises, liquidity was provided to banks.

This result complies with Panetta et al. (2009). They showed capital injections reduce the risk of bank defaults that would happen in the absence adequate liquidity. Claessens et al. (2011), Laeven and Valencia (2011) and Laeven and Valencia (2010) identified that banks were recapitalised much faster during the last financial crisis than in previous crises. Aït-Sahalia et al. (2010) show that announcements of liquidity infusion raise the creditworthiness of banks.

However, the prevention of bankruptcy is an expensive exercise. Cottarelli and Vinals (2009) argue that containment actions significantly increase the risk exposures of the lender of last resort. In addition, Stone et al. (2011) point out that exceptional liquidity support supplant markets.

Liquidity support might be granted either to all market players or only to selected banks. Claessens et al. (2001) and Freixas et al. (1999) highlight that it is hard to distinguish between solvent and insolvent market players during a crisis.

Bagehot (1873) argue that liquidity shall be provided at a penalty rate in order save the individual market players without gaining any profit advantage that should discipline the bank in future (Singh, 2011).

Despite the disadvantages Stone et al. (2011) emphasise that liquidity provision is appropriate when there is liquidity stress. Singh (2011) urge that any assistance requires continued actions until a final solution for the bank is found. This complies with the results of this research. The provision of liquidity to banks is categorised as an unsustainable action.

The short-term assistance of the lender of last resort does not convince investors. Panetta et al. (2009) pointed out that bank stock prices did not show a positive reaction to announcements of capital injections to banks. They explained the effect by the dilution of rights of existing shareholders and concerns about long-term profitability.

The provision of liquidity is one action of assistance. Ingves and Lind (2008) suggest that instead of "lenders of last resort" "investors of last resort" are required. They could purchase assets from banks. This aspect is part of discussions on possible central bank and government actions.

7.1.3 Effectiveness of actions of governments and regulators

The third research question asks: How effective are the crisis containment actions of governments and regulators?

The containment actions are listed in Chapters 2.3 and 4.5.3. The analysis results are documented in Chapters 5.1.1, 5.2.1 and 5.3.1 and summarised in Chapter 5.4.1.

The results of the analysis suggest that no action of governments and regulators is sustainable, powerful enough to change the system's behaviour and capable of having exclusively positive effects.

However, the debt moratoria for financed investors covers most aspects without being sustainable meaning that for the same effect, the action needs to be applied again. The initial impulse is not automatically amplified in the long-term. The majority of containment actions of governments and regulators are slightly sustainable. Only the prohibition of short sales and debt moratoria for financed investors are unsustainable. The power to change the system behaviour without overshooting is only possible for debt moratoria for financed investors. Deposit insurance, guarantees and nationalisation, asset transfer programmes and accounting discretions decrease the asset price. All actions except debt moratoria for financed investors increase bank liquidity. The actions are mostly attended by a drop in the foreign exchange rate. Just the actions debt moratoria for financed investors, the closure of exchanges and the prohibition of short sales lead exclusively to positive effects.

Deposit insurance, guarantees and nationalisation

This research shows that deposit insurance, guarantees and nationalisation are not powerful actions and that they decrease asset prices. However, the liquidity of banks may slightly improve. The initial impulse can be seen as being slightly sustainable. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, money supply, interbank lending and the asset cash flow of financed investors play significant roles. Side-effects have to be considered. An increase of the creditworthiness of banks increases the asset demand. If the liquidity of banks is increased by this action, the asset demand, the market risk-return ratio and the attractiveness of assets increase as well. The historical evaluation shows that the creditworthiness of banks were increased during most financial crises.

These results are consistent with findings of several other studies. Grande et al. (2013) observed that guarantees help bank funding and Cumming (2013) highlights the benefits of deposit insurance compared to bank runs and contagion. Calomiris et al. (2012) argue that

without a government guarantee depositors would have an urge to concern themselves with their bank`s solvency. The results of this research show that the liquidity of banks only slightly increase, conforming to Mayes (2013) whose results show that guarantees have only a limited role in the financial safety net. Aït-Sahalia et al. (2010) show that the announcements of guarantees increase the creditworthiness of banks.

According to Schich (2009) guarantees have become a key action to contain financial crises identifying the lower initial costs compared to other options as the main reason.

Singh (2011) defined the requirements necessary to have any effect. First, the market must believe that the guarantor honours the guarantee. That is why Cumming (2013) argues that implicit guarantees are less effective than explicit ones. Second, the amount must only provide the minimum necessary protection and, third, there must be enough power to restore the system's solvency. Grande et al. (2013) and Panetta et al. (2009) emphasise that guarantees only reflects the creditworthiness of the guarantor. According to Kane and Klingebiel (2004) the most important step is it to support only viable institutions.

The same question arises for guarantees as in the case of the lender of last resorts. Should actions be attended with fees? Governments and regulators should charge premiums for providing guarantees as a compensation for their risk they underwrite (Schich, 2009).

Asset purchases programme

This research shows that asset purchases programme are no powerful actions. However, the liquidity situation of banks can be improved. In addition, this action can be seen as slightly sustainable. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. The historical evaluation shows asset programmes were applied during the most recent financial crises.

For the effects of the asset purchase programme, the direct and indirect interrelations to asset prices, the risk of contagion, new loans for investments, creditworthiness of banks, money supply and interbank lending play considerable roles. Side-effects have to be considered. An increase of the liquidity of banks increases the market risk-return ratio and the attractiveness of assets.

Klingebiel (2000) suggests that only in extreme cases should assets be purchased from unviable institutions. The purchasing asset management company requires some organisational pre-conditions for the official institution. There should be professional management, political independence, adequate funding, effective bankruptcy laws and transparency. Honohan (2012) recommends this action should be combined with the replacement of an incompetent management.

Asset transfer programme

This research shows that asset transfer programmes are not powerful actions. Asset transfer programmes slightly increase the liquidity of banks, conforming to Klingebiel (2000) who suggests that asset management companies are rarely good measures to improve corporate restructuring, which was confirmed in another research about stock market responses to such actions (Klingebiel et al., 2001). In addition, this action can be seen as slightly sustainable meaning that for the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. The historical evaluation shows asset programmes were applied during almost all financial crises. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, money supply, interbank lending and the asset cash flow of financed investors play considerable roles. Side-effects have to be considered. An increase of the creditworthiness of banks increases the asset demand. If the liquidity of banks should be increased by this action, the asset demand, the market risk-return ratio and the attractiveness of assets increase.

Debt moratoria for financed investors

This research shows that a debt moratorium is a powerful action. It can increase asset prices and the foreign exchange rate without reducing the liquidity of banks. The initial impulse is not sustainable meaning that for the same effect, the action needs to be applied again. The initial impulse is not automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to the asset cash flow of financed investors, payments for loans, asset prices, new loans, the asset demand, the risk of contagion and interbank lending play considerable roles. There are side-effects. A decrease of payments for loans causes an increase of the general rate of interest and foreign exchange rate. By increasing the foreign exchange rate through a debt moratorium, the risk

of contagion decreases and further new loans for investments are granted, while the creditworthiness of financed investors increases. However, the market risk-return ratio, the attractiveness of assets, and the creditworthiness of banks decrease and the cost of new loans increases. The historical evaluation shows that a debt moratorium had not been applied during the studied financial crises.

Accounting discretion

This research shows that accounting discretion is not a powerful action. However, the liquidity position of banks can be improved. In addition, it can be seen as slightly sustainable. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, money supply, interbank lending and the asset cash flow of financed investors play considerable roles. Side-effects have to be considered. An increase of the creditworthiness of banks increases the asset demand. If the liquidity of banks is increased by this action, the asset demand, the market risk-return ratio and the attractiveness of assets increase. The historical evaluation shows that accounting discretion had been applied during the majority of domestic financial crises.

Deposit freezing or bank holidays

This research shows that deposit freezing or bank holidays are not powerful actions but slightly sustainable meaning that for the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. Only the liquidity position of banks could be strengthened. For the effects of these actions, the direct and indirect interrelations to asset prices, the risk of contagion, new loans for investments, creditworthiness of banks, money supply and interbank lending play considerable roles. Side-effects have to be considered. An increase of the liquidity of banks increases the market risk-return ratio and the attractiveness of assets. The historical evaluation shows that this action had not been applied during the analysed financial crises.

Bank holidays on exchanges

Bank holidays on exchanges are very powerful actions but their effects might lead to unpredictable situations. Asset prices would increase, the liquidity position of banks can

improve without diluting the foreign exchange rate. In addition, it can be seen as being slightly sustainable. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. For the effects of this action, the direct and indirect interrelations to expected returns of assets, the creditworthiness of financed investors, the risk of contagion, liquidity of banks, the asset cash flow of financed investors, money supply, interbank lending and new loans for investments play considerable roles. An increase of bank liquidity due to bank holidays on exchanges has positive side effects for the asset demand but negative side effect for the risk of contagion. The historical evaluation shows that such action is uncommon during financial crises.

According to Colesanti (2010), if circuit breakers are identified as an effective action, they should be modified. Large drops seldom occur. At the moment, the exchange stops are matched with an absolute value. Instead relative values should be introduced.

Stress test

This research shows that stress tests are not powerful actions but slightly sustainable. For the same effect, the action does not need to be applied again. The initial impulse is automatically amplified in the long-term. Asset price would raise and the liquidity situation of banks would improve. For the effects of this action, the direct and indirect interrelations to interbank lending, asset prices, risk of contagion, money supply and the asset cash flow of financed investors play considerable roles. The historical evaluation shows that stress tests are new actions adopted during financial crises.

Stress tests strive to reduce uncertainty and this research shows that they increase the liquidity of banks. Taylor (2009) suggests that uncertainty was the root cause of the last financial crisis. Ingves and Lind (2008) and Pritsker (2012) argue that stress tests can restart markets by reducing uncertainty. Transparency plays an important role in restoring confidence.

Prohibition of short sales

This research shows that the prohibition of short sales is neither a powerful action nor sustainable. For the same effect, the action needs to be applied again. The initial impulse is not automatically amplified in the long-term. However, asset prices would increase and the

liquidity situation of banks can be improved without negative effects on the foreign exchange rate. For the effects of these actions, the direct and indirect interrelations to asset demand, asset supply, asset prices, the risk of contagion, interbank lending, money supply and cash flow of financed investors play considerable roles. The historical evaluation shows that the prohibition of short sales is a new action during financial crises. However, even US President Hoover had considered a ban during the great financial crisis of 1929 (Chernow, 2010).

These results are consistent with empirical studies indicating that restrictions on short-selling lead to artificially inflated prices (Frino et al., 2011; McMillan and Philip, 2012).

7.1.4 Effectiveness of potential new actions

The fourth research question asks: Which potential new containment actions might be effective?

The analysis results of potential new containment actions are documented in Chapters 5.1.2, 5.2.2 and 5.3.2 and summarised in Chapter 5.4.2.

An increase in the expected return of the asset has positive effects on asset prices and the liquidity of banks. The potential new action is sustainable and powerful. For the effects of this action, the direct and indirect interrelations to the asset risk-return ratio, asset prices, the risk of debt default, the cash flow of financed investors, interbank lending and money supply play considerable roles.

An decrease in payments for new loans has positive effects but the potential new actions is neither sustainable nor powerful. For the effects of this action, the direct and indirect interrelations to payments for loans, asset prices, the risk of debt default, the asset cash flow of financed investors, interbank lending and money supply play important roles. Side effects have to be considered. This action causes an increase of the general rate of interest. By increasing the foreign exchange rate by this action the risk of contagion decrease and new loans for investments as well as the creditworthiness of financed investors increase. However, the market risk-return ratio, the attractiveness of assets and the creditworthiness of banks would decrease and costs of new loans would increase.

7.1.5 Interferences of actions

The fifth research question asks: Which combination of financial crisis actions causes interferences?

The analysis results are documented in Chapter 5.5.

The results of the analysis suggest that, in case of countries facing an isolated domestic financial crisis, just a few actions may help to reach the desired goals. Increased asset prices, liquidity of banks and stable foreign exchange rates can be achieved by the increasing the asset demand, the artificial stabilisation of the foreign exchange rate, the granting of a debt moratorium for financed investors, the prohibition of short sales and on the closing of exchanges. As a potential new action payments for new loans should be reduced. All other actions lead to negative side-effects.

An international financial crisis might be handled differently. Central banks may arrange a simultaneous extension of money supply resulting in a stable foreign exchange rate of the most important currencies. In this case, the majority of the actions might be applied to increase the asset price and the liquidity of banks without side-effects. The increasing of interest rates, an artificial depreciation of domestic currency, purchases of assets from markets, the lightening of collateral requirements, deposit insurance, guarantees and nationalisation, asset transfer programmes, accounting discretion and the decreasing of new loans for investments should be avoided. The historical analysis partly strengthens this view. Less applied not-recommended actions seem to lead to shorter durations of asset price recovery and less likely currency crises.

Singh and LaBrosse (2011) and LaBrosse and Singh (2013) developed a decision tree surrounding financial crises. The goal of their action framework is to curb the spread of an active financial crisis. They defined different sub-goals that might be summarised as increased liquidity for banks and increased asset prices. In general, their proposed actions are linked to the general market conditions and to the solvency of individual market participants. According to their framework, liquidity is to be provided to market participants with good solvency and good collateral. This complex system approach shows that this action increases the liquidity of banks but there are no effects on asset prices.

According to their framework, an asset transfer programme should be initiated and institutions nationalised in case of a poor solvency of market participants. According to this complex system approach, both actions improve the liquidity position of banks but decrease asset prices. In addition, they recommend asset purchases and guarantees to support market viability. According to this complex system approach these actions increase the liquidity of banks but the asset prices do not raise. Asset purchases from markets, however, would have a different effect. Asset prices increase but the liquidity of banks decreases.

Several scientists suggest a combination of actions. The combined effects were analysed in this research. Singh (2011) suggests that the combination of guarantees and recapitalisation are effective to prevent a meltdown. This complex system approach shows that these combined actions increase the liquidity of banks but have negative effects on the asset price and the foreign exchange rate. Therefore, he is right if he limits the meltdown to the liquidity position of banks. Laeven and Valencia (2011) and Claessens et al. (2001) suggest that guarantees, asset purchases from banks and liquidity support are not individually significant but in combination. Combined they increase the asset price and the liquidity of banks and reduce the foreign exchange rate in case of a domestic crisis. During an international financial crisis, there are no negative side-effects.

Claessens et al. (2011) suggest that stress tests should be conducted and accompanied by recapitalisation plans. Together they increase asset prices and the liquidity of banks but the foreign exchange rate drops in case of domestic financial crises according to the complex system approach.

Blanchard et al. (2010) and Honohan (2012) suggest the combining of two actions. Assets shall be purchased from banks and, simultaneously, the monetary policy shall be handled restrictively. However, this complex system approach shows that a low money supply decreases asset prices and the liquidity of banks. Asset purchases from banks would offset the decreased liquidity of banks but not the fall in asset prices. The effects on the foreign exchange rate should be equalised. In sum, there are no positive effects.

Claessens et al. (2001) and Vinals and Nier (2014) highlight that consistency in adopted actions is the key to success. Independent actions of different institutions might lead to conflicts. If central banks increase the general rate of interest, asset prices and the liquidity of banks fall but the exchange rate increase. If regulators simultaneously provide a guarantee for banks, the effects are neutralised. In the end, asset prices fall and the liquidity of banks as well as the foreign exchange rate do not improve. Constellations like this are the reason why scientists discuss the organisational aspects of institutions (Borio, 2011; Singh and LaBrosse, 2011; Singh, 2011), which is in line with Doerner (1997) who shows that an effective action depend on a number of decisions. His studies reveal that those with a good performance record decide more than those with a poor performance chart. Goodhart (2011) discussed that central banks and micro-prudential institutions should collaborate. A new macro-prudential authority might be developed. It should neither be an entirely new institution to avoid track record and history nor should it be yet another independent authority. He recommends a new authority that is linked to the central bank and in the best case to the micro-prudential authority. Ueda and Valencia (2012) argue differently. They recommend a separation of a macro-prudential authority and central banks. When a central bank is responsible for price stability and financial stability, a time inconsistency arises. Actions to regulate financial stability cannot be adjusted as frequently as actions to regulate price stability. Since the autumn of 2014 the European Central Bank has covered both monetary policy and banking supervision for large banks (European Central Bank, 2014). Next to the argument of consistent decisions, the organisation of institutions can effect the handling of information. A study show that information asymmetries can have an impact on containment actions (Gandrud and O'Keeffe, 2016), which can be initiated by the interpretation of signals of other institutions.

The first part of the seventh chapter consolidated relevant information from the systemic analysis and the historical evaluation for each action and in combination and compared these outcomes to statements of other scientists. The next section looks at general patterns and suggests further research.

7.2 Policy contributions, appraisal of outcomes and further research

This section summarises the policy contributions, appraises the outcomes and shows the potential extensions of this research. Chapter 7.2.1 shows three interesting patterns of the outcomes. Chapter 7.2.2 mentions the policy contributions and Chapter 7.2.3 describes possible extensions of the research.

7.2.1 Appraisal of outcomes

The conclusions and discussion show three interesting patterns.

The results of this analysis suggest that there is not a single miraculous action which can contain a financial crisis by itself. Neither central banks, lenders of last resort nor governments and regulators have an ultimate containment action that can be seen as sustainable and powerful, leading exclusively to positive effects. However, there are actions which can help. A few actions that can be seen as strong enough to change the system's behaviour or can be seen as sustainable. The majority of actions might increase asset prices and improve the liquidity of banks. The effectiveness of actions differs if the link to other currency areas is considered with the currency exchange rate. The majority of effective actions decrease the foreign exchange rate. This aspect leads to different results for domestic and international financial crises. More of containment actions can be applied during a crisis if the foreign exchange rate is ignored. This might happen in case of an international financial crisis. Economically leading countries caught up in a crisis can coordinate their exchange rate policies. In contrast, in the case of a domestic crisis, only a few options are available. The historical analysis, in part, strengthens this view. Less applied not-recommended actions seem to result in shorter durations of asset price recovery and seem to cause less of likely currency crises.

There is one obstacle to the discussion of results. There are only a few publications, containing an assessment of financial crisis containment actions. Therefore, an extensive comparison of the results of this thesis with other research is extremely limited. All identified publications are discussed in Chapter 7.1 in detail. From an overall perspective, there is an interesting pattern. The results of this research comply with almost all existing publications., the majority of them discuss just the effects of specific actions on a specific

goal during financial crises.[28] Only a few publications make more general statements about the effectiveness of actions. Even these assessments are covered by the results of this research.[29] Only a minority of the statements do not comply with the results of this complex system approach.[30]

This research analyses the consequences of interventions within complex systems by counting cycles and paths from a specific element that can be triggered by a specific action. There are two important findings. First, instead of a clearly positive or negative impact of the actions taken, this research shows that almost every positive or negative impulse triggers almost the same number of effects reversing the desired effect. Second, independent of the chosen action, almost the same elements play significant roles in the effects of actions. Asset prices are often influenced by aspects of debt default, the cash flow of financed investors and the risk of contagion. The same elements are relevant for effects on the liquidity of banks. They are only completed by aspects of asset prices. The mentioned aspects also influence the foreign exchange rate. In addition, new loans for investments, uncertainty, including interbank lending and money supply, have to be considered.

[28] The following publications are consistent with the results of this research. Mishkin (2009) identified that an extension of money supply causes higher asset prices. Lahiri and Vegh (2003) suggest that higher interest rates attract foreign investors . Bernanke et al. (2004) mentioned the effects of the general interest rate and the asset purchases on asset prices. Laeven and Valencia (2011) and Stone et al. (2011) discussed that more asset purchases from banks increase the liquidity of banks. Ghosh et al. (2009) argue that the lightening of collateral requirements increases the liquidity of banks. Panetta et al. (2009) summarised that the lender of last resort increases the liquidity of banks. Grande et al. (2013) and Calomiris et al. (2012) and Stone et al. (2011) discussed that guarantees increase the liquidity of banks and Mayes (2013) mentioned that effects are limited. Klingebiel (2000) mentioned that asset transfers might slightly increase the liquidity of banks. Singh and LaBrosse (2011), LaBrosse and Singh (2013) and Singh (2011) identified in their decision tree appropriate actions to increase the liquidity of banks.

[29] The following publications are consistent with the results of this research. Stone et al. (2011) named the appreciation of domestic currency as an effective action. Lahiri and Vegh (2003) suggest that higher interest rates worsen the crisis in the long run. Goodfriend and King (1988) discuss that the lightening of collateral requirements should not be accomplished. The following publications are consistent with the results of this research by assuming an international financial crisis. Friedman and Schwartz (2007) identified that an extension of money supply might be effective. Laeven and Valencia (2011) and Claessens et al. (2001) discuss that the combination of guarantees, asset purchases and liquidity of banks might be effective.

[30] The following publications are not consistent with the results of this research. The decision tree of Singh and LaBrosse (2011) and LaBrosse and Singh (2013) listed actions to increase asset prices. According to the complex system approach they do not have the intended effects. The same happens with proposal of Blanchard et al. (2010) and Honohan (2012) who suggest to purchase assets from banks and reduce the money supply.

7.2.2 Policy contributions

During domestic financial crises, the chosen actions have to focus on improvements on the three key elements asset price, liquidity of banks and foreign exchange rate (see Chapter 2.3), which however only a few actions can achieve (see Chapter 5.5). The actions "Appreciation of domestic currency" is normally initiated by central banks while the actions "Debt moratoria for financed investors", "Bank holidays on exchanges" and "Prohibition of short sales" are normally initiated by governments and regulators. A potential new action could be the "Decreasing of payments for new loans". All other actions have at least one negative effect on the key elements.

During international financial crises more of containment actions can be applied if the foreign exchange rate, one of the key elements, is ignored. Economically leading countries can coordinate their exchange rate policies (see Chapter 5.5). In this case, central banks can initiate positive effects by applying the actions "Extension of money supply", "Decreasing of general interest rate", "Appreciation of domestic currency" and "Asset purchases from banks". In addition, all actions of the lender of last resort are helpful. Governments and regulators can intervene with the actions "Asset purchase programme", "Debt moratoria for financed investors", "Deposit freezing or bank holidays", "Bank holidays on exchanges", "Stress tests" and "Prohibition of short sales". Potential new actions with increasing effects on asset prices and the liquidity of banks are "Increasing of expected return of asset" and "Decreasing of payments for new loans".

7.2.3 Further research

The research might be extended by different research questions, a different modelling approach, an extended financial crisis model and an extended historical examination.

Different research questions

The research questions of this research focused on the analysis of containment actions during financial crises. Further research might extend the scope of analysing the effectiveness with regard to the prevention or resolution of financial crises (see Chapter 2.3).

In addition, research questions might study interferences of containment actions with resolution and prevention actions. The question could be answered if actions exist that always have positive effects to prevent, contain and resolve financial crises.

Different modelling approach

The complex system modelling approach of this research rests on several assumptions. Further research might change the modelling approach. For example, this modelling discerns three different intensities for interrelations. This might be extended. Instead of modelling simple values of weak, standard and strong interrelations, functions might describe their interaction.

Changed modelling constraints influence possible analytical techniques. This research concentrated on structural analyses of systems. With modified modelling functions, the system's behaviour could be simulated. More details could be quantified and interpreted. The for simulations required initial values of elements could be gathered for a selected currency area.

Extended financial crisis model

The developed financial crises model is based on an existing financial crisis framework (see Chapters 2.2, 2.3 and 4). It is developed to assess the effectiveness of containment actions. In addition, an extended model could consider long-term consequences for the lender of last resort. It is not necessary to assess the effectiveness of containment actions that exclusively focus on short-term goals but it is a valid point for policy makers. In the end, this requires the described extension of the research questions. Interferences of containment actions with resolution and prevention actions have to be identified.

This model covers standard theories about asset pricing. There are theories from the scientific field of behavioural finance that might be integrated into the model. For example, Odean (1998) identified a tendency among investors to hold low performing investments too long and sell winning investments too soon by analysing large data sets, while Kamstra et al. (2003) found a link between people's moods and sunlight. More of daylight might lead to a better mood, which may, in turn, lead to more risky behaviour.

This model allows the analysis of an entire financial crisis. Consequences for single firms or banks are out of its scope. During the last financial crisis, governments forced banks to accept liquidity support in order to avoid a loss of confidence among their customers that could possibly trigger a bank run. These aspects could be researched as well.

The developed complex system for financial crises focussed on one currency area. It might be interesting to extend the model to more currency areas in order to analyse the consequences of foreign action on them.

Extended historical examination

The second part of this research focussed on the collection of information about historical crises in order to strengthen the results of the complex system approach. One obvious extension might be the collection of information from a greater number of crises in order to falsify the outcome of effective actions according to the complex system approach. At the moment, it cannot be said that the positive effects on the indicators are caused by the applied actions. Other factors, too, may have influenced the indicators.

On the other hand, the research approach could be changed. Instead of the deductive approach of the second phase of this research, an inductive approach could be chosen. The collected information of historical financial crises can be used to analyse the effectiveness of actions without a previous complex system approach. The data can be statistically matched with indicators of successful financial crisis containment. In this research, the indicators of duration of asset price recovery, the number of bank closures and currency crash were applied. The analysis could show which actions have the best effects on the indicators. More importantly, this approach requires a larger data set for the application of statistical tools.

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London South Bank
University

Division of Accounting and Finance
Centre for Research in Accounting, Finance and Governance
School of Business

Financial crisis containment:
An analysis and evaluation of relevant actions applying a complex system approach

-Appendices-

DANIEL COPPI

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Appendix 1: Cycles of the system

This chapter shows all identified cycles of the systemic financial crisis model. The details of this chapter are interpreted in Chapter 5.1. The background of this kind of analysis is described in Chapter 3.4.2.

The table summarises several kind of information. The first column consecutively numbers the identified cycles. The second column shows the chain of elements of the cycles and the third column shows the direction of the cycle. The value 1 defines a positive cycle which means that the initial impulse to one of the elements is amplified. The value -1 defines a negative cycle which causes a reversal of the initial impulse to one element of the cycle. The remaining columns shows the involved elements. The value 1 stands for an involvement and the value 0 means no involvement.

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	{1, 1}	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	{2, 2}	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	{1, 3, 13, 10, 11, 12, 1}	1	1	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
5	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
6	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
7	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
8	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
9	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
10	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
11	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
12	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
13	{1, 3, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
14	{1, 3, 13, 10, 11, 12, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
15	{1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
16	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	0
17	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
18	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
19	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1
20	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	1
21	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1
22	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1
23	{1, 3, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
24	{1, 3, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
25	{1, 3, 13, 10, 14, 18, 17, 15, 23, 19, 12, 1}	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0
26	{1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
27	{1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1}	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0
28	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1}	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	0
29	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
30	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
31	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
32	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	0	1	0	0	0	0	0	1	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1	1
33	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
34	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
35	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
36	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
37	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1}	-1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
38	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	1	1
39	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
40	{1, 3, 13, 10, 14, 18, 19, 12, 1}	-1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
41	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0
42	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0
43	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
44	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
45	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
46	{1, 3, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
47	{1, 3, 20, 5, 6, 8, 1}	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
48	{1, 3, 20, 5, 11, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
49	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0
50	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	1	0	0	0	0
51	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0
52	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	1
53	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	1
54	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
55	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
56	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	0	1
57	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
58	{1, 3, 20, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	0
59	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	1	0	0	0	0
60	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0
61	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
62	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1
63	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1
64	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
65	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1
66	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1
67	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
68	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	1	0	0	1	1	0	0	0	0
69	{1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
70	{1, 3, 20, 5, 11, 12, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
71	{1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0
72	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0
73	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
74	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
75	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
76	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
77	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
78	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
79	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
80	{1, 3, 20, 5, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0
81	{1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1}	1	1	0	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
82	{1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
83	{1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0
84	{1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0
85	{1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
86	{1, 3, 20, 5, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
87	{1, 3, 20, 5, 17, 15, 23, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	0	0	0	0
88	{1, 3, 20, 5, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0
89	{1, 3, 20, 5, 17, 15, 24, 23, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0
90	{1, 3, 20, 5, 17, 15, 25, 26, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	1	0	0
91	{1, 3, 20, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
92	{1, 3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
93	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
94	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	1	1	0	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
95	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
96	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
97	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	1	0	0	0	0	1	1	0	1
98	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
99	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	1	1	1
100	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
101	{1, 3, 20, 5, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	1	0	1
102	{1, 3, 20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
103	{1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
104	{1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1
105	{1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	1	1	1
106	{1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
107	{1, 3, 20, 21, 1}	-1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
108	{1, 3, 21, 1}	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
109	{1, 3, 22, 4, 6, 8, 1}	-1	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
110	{1, 3, 22, 5, 6, 8, 1}	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
111	{1, 3, 22, 5, 11, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
112	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0
113	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	0	0
114	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	0
115	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1
116	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1
117	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
118	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
119	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	1	0	1
120	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
121	{1, 3, 22, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0
122	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0
123	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0
124	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0
125	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1
126	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1
127	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
128	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1
129	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	1
130	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
131	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	0	0	0	0
132	{1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
133	{1, 3, 22, 5, 11, 12, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
134	{1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
135	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0
136	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
137	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
138	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
139	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
140	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
141	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
142	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
143	{1, 3, 22, 5, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0
144	{1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1}	1	1	0	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0
145	{1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
146	{1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0
147	{1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	1	0	0	0	0	0	0
148	{1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
149	{1, 3, 22, 5, 17, 15, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
150	{1, 3, 22, 5, 17, 15, 23, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	0	0	0	0
151	{1, 3, 22, 5, 17, 15, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
152	{1, 3, 22, 5, 17, 15, 24, 23, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0
153	{1, 3, 22, 5, 17, 15, 25, 26, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	0	0	1	1	0	0
154	{1, 3, 22, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0
155	{1, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
156	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
157	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	1	1	0	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
158	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
159	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
160	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	1	0	0	1	1	0	1
161	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
162	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0	0	1	1	1	1
163	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
164	{1, 3, 22, 5, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	0	0	1	1	0	1
165	{1, 3, 22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1}	-1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
166	{1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
167	{1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	1
168	{1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	0	0	1	1	1	1
169	{1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1}	1	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
170	{1, 23, 2, 3, 13, 10, 11, 12, 1}	1	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
171	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
172	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
173	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1
174	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1
175	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1}	1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	0
176	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
177	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
178	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	1	1	0	0	0	0	0	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	1
179	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
180	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	1
181	{1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 1}	-1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0
182	{1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
183	{1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
184	{1, 23, 2, 3, 20, 5, 6, 8, 1}	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
185	{1, 23, 2, 3, 20, 5, 11, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
186	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	0	1
187	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	0	1
188	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1
189	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1
190	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
191	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
192	{1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1}	1	1	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
193	{1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	0	0
194	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	0
195	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
196	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
197	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	1	1	1	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
198	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1
199	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	1	1
200	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1
201	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	1	1
202	{1, 23, 2, 3, 20, 21, 1}	-1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
203	{1, 23, 2, 3, 21, 1}	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
204	{1, 23, 2, 3, 22, 4, 6, 8, 1}	-1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
205	{1, 23, 2, 3, 22, 5, 6, 8, 1}	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
206	{1, 23, 2, 3, 22, 5, 11, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
207	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	1	0	1
208	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	1	0	1
209	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	1
210	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	1
211	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
212	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
213	{1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1}	1	1	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
214	{1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0
215	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	0
216	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
217	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
218	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	1	1	1	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
219	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1
220	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	1	1
221	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19, 12, 1}	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	1
222	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	-1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	1	1
223	{1, 23, 7, 8, 1}	-1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
224	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 1}	-1	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
225	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1}	-1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	0
226	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	1
227	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1}	-1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
228	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1}	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	1	1
229	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 1}	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
230	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
231	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
232	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	1	1	1	1	0	1	0	1	1	0	1	0	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	0	0
233	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	0
234	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
235	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	1	1	1	1	0	1	0	1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1
236	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	1	1	1	1	0	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	1	1
237	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1
238	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	1	1
239	{1, 23, 7, 8, 2, 3, 20, 21, 1}	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0
240	{1, 23, 7, 8, 2, 3, 21, 1}	-1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
241	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
242	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
243	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1}	1	1	1	1	0	1	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	1	1	0	0	0	0	0
244	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	0
245	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1}	-1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
246	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1}	1	1	1	1	0	1	0	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1
247	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1}	1	1	1	1	0	1	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	1	1
248	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19, 12, 1}	-1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	1
249	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1}	1	1	1	1	0	1	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	1	1
250	{1, 23, 19, 12, 1}	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
251	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1}	-1	1	0	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1
252	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1}	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1
253	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1}	-1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	1	0	1	0	1	1	0	1
254	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1}	1	1	0	1	1	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1
255	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1}	-1	1	0	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1
256	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
257	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1}	-1	1	1	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1
258	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1}	1	1	1	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	1	1	0	1	0	1	0	1	1	0	1
259	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
260	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1}	1	1	1	1	0	0	0	1	1	1	0	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1
261	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1}	-1	1	1	1	0	0	0	1	1	1	0	0	1	0	1	1	0	1	1	1	0	1	0	1	0	1	1	0	1
262	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1}	-1	1	0	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	0	1
263	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1}	1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1
264	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1}	-1	1	0	1	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	0	1
265	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1}	1	1	0	1	1	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1
266	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1}	-1	1	0	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1
267	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1}	1	1	0	0	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1
268	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1}	-1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1
269	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1}	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	1
270	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1}	-1	1	0	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1
271	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1}	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1
272	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1}	-1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	1
273	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1}	1	1	0	1	0	1	1	0	1	0	0	0	1	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	1
274	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1}	-1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	1	0	1	0	1	1	0	1
275	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3, 21, 1}	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
276	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1}	-1	1	0	1	1	0	1	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	1
277	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1}	1	1	0	1	0	1	1	0	1	0	0	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	1
278	{1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1}	-1	1	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1
279	{1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1}	1	1	1	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	1	1	1	0	1	0	1	1	0	1
280	{1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1}	-1	1	1	1	0	0	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1
281	{1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1}	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1
282	{1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1}	-1	1	1	1	0	0	0	1	1	1	0	0	1	0	0	1	0	1	0	1	1	1	0	1	0	1	1	0	1
283	{1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1}	1	1	1	1	0	0	0	1	1	1	0	0	1	0	0	1	0	1	0	1	0	1	0	1	0	1	1	0	1
284	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
285	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
286	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
287	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
288	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
289	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
290	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
291	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
292	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
293	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
294	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
295	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
296	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
297	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
298	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
299	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
300	{2, 3, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
301	{2, 3, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
302	{2, 3, 13, 10, 11, 12, 17, 15, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
303	{2, 3, 13, 10, 11, 12, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0
304	{2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
305	{2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0
306	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	0
307	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	0
308	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
309	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
310	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	1	0	1	0	0	0	0	1	1	1	1	1	1
311	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1
312	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	1
313	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	0	1
314	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1
315	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	0	1	1	0	1
316	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1
317	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	0	1	1	1	1	1	1
318	{2, 3, 13, 10, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
319	{2, 3, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	1	1	1	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0
320	{2, 3, 13, 10, 14, 18, 17, 15, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0
321	{2, 3, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
322	{2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
323	{2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	0
324	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
325	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	0
326	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
327	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
328	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	1	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
329	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
330	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
331	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	0	1
332	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
333	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	0	0	0	0	1	0	1	1	0	1
334	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
335	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	1
336	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0
337	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0
338	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0
339	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0
340	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
341	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
342	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
343	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
344	{2, 3, 13, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
345	{2, 3, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	0	0	1	1	0	1	0	0	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0
346	{2, 3, 20, 5, 6, 8, 2}	1	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
347	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0
348	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0
349	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	1	0	0	0	0
350	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	1	0	0	0	0
351	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0
352	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0
353	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	1
354	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	1
355	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
356	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
357	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
358	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
359	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	0	1
360	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	0	1
361	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
362	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1
363	{2, 3, 20, 5, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	0
364	{2, 3, 20, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	0
365	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	0	0
366	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	0	0	0	0
367	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
368	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0
369	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
370	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0
371	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1
372	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1
373	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
374	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
375	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1
376	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1
377	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1
378	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	1	0	1
379	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
380	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1
381	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	0	1	0	1	1	1	0	0	1	1	0	0	0	0
382	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	1	0	0	1	1	0	0	0	0
383	{2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
384	{2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
385	{2, 3, 20, 5, 11, 12, 17, 15, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
386	{2, 3, 20, 5, 11, 12, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
387	{2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0
388	{2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0
389	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0
390	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0
391	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
392	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
393	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
394	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
395	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
396	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
397	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
398	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
399	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
400	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
401	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
402	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
403	{2, 3, 20, 5, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0
404	{2, 3, 20, 5, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0
405	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
406	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
407	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0
408	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	1	1	0	0	1	1	0	0	0	0
409	{2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
410	{2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	0
411	{2, 3, 20, 5, 17, 15, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
412	{2, 3, 20, 5, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
413	{2, 3, 20, 5, 17, 15, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
414	{2, 3, 20, 5, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	1	0	0	0	0
415	{2, 3, 20, 5, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0
416	{2, 3, 20, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0
417	{2, 3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
418	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
419	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
420	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
421	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
422	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
423	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	0	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
424	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	1	0	0	1	1	1	1	0	1
425	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
426	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
427	{2, 3, 20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
428	{2, 3, 20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	1
429	{2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
430	{2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	1	1	0	1
431	{2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
432	{2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1	1
433	{2, 3, 20, 21, 2}	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
434	{2, 3, 21, 2}	-1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
435	{2, 3, 22, 4, 6, 8, 2}	-1	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
436	{2, 3, 22, 5, 6, 8, 2}	1	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
437	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0
438	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0
439	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	0	0
440	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	0	0
441	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	0
442	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	0
443	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1
444	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1
445	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
446	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
447	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
448	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
449	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	1	0	1
450	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	0	1	1	0	1
451	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
452	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1
453	{2, 3, 22, 5, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0
454	{2, 3, 22, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	1	0	0	0	1	1	0	0	1	1	1	0	0	0	0
455	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0
456	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0
457	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0
458	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0
459	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
460	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0
461	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1
462	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1
463	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
464	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
465	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1
466	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	1
467	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	1
468	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	1
469	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
470	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
471	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	0	0	0	0
472	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	1	1	1	0	0	0	0
473	{2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
474	{2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
475	{2, 3, 22, 5, 11, 12, 17, 15, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
476	{2, 3, 22, 5, 11, 12, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
477	{2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
478	{2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
479	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0
480	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0
481	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
482	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
483	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
484	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
485	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
486	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
487	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
488	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
489	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
490	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
491	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
492	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
493	{2, 3, 22, 5, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0
494	{2, 3, 22, 5, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0
495	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
496	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
497	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0
498	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	1	1	1	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0
499	{2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
500	{2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	0	0	0	0
501	{2, 3, 22, 5, 17, 15, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
502	{2, 3, 22, 5, 17, 15, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0
503	{2, 3, 22, 5, 17, 15, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
504	{2, 3, 22, 5, 17, 15, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	0	0	0
505	{2, 3, 22, 5, 17, 15, 25, 26, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
506	{2, 3, 22, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	0
507	{2, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
508	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
509	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
510	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
511	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
512	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
513	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
514	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1
515	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
516	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	1	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
517	{2, 3, 22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 2}	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
518	{2, 3, 22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2}	-1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	0	1
519	{2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
520	{2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1
521	{2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2}	-1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
522	{2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2}	1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	1	1	1	1	1
523	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
524	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
525	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
526	{3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
527	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	1	0	0	0	0	1	1	0	1
528	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1
529	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
530	{3, 20, 5, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	1	0	1
531	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	1	0	1
532	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1	0	0	1	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1
533	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
534	{3, 22, 5, 17, 15, 25, 26, 28, 3}	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1
535	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9}	-1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
536	{9, 10, 11, 12, 17, 15, 25, 26, 28, 9}	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	1
537	{9, 10, 14, 18, 17, 15, 25, 26, 28, 9}	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	1	1	0	1
538	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9}	-1	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
539	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9}	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	1	1	1	0	0	0	0	0	1	1	1	1
540	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9}	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1
541	{9, 27, 19, 12, 17, 15, 25, 26, 28, 9}	-1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1	1
542	{10, 11, 12, 14, 18, 16, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
543	{10, 11, 12, 14, 18, 17, 15, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0
544	{10, 11, 12, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
545	{10, 11, 12, 17, 15, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
546	{10, 14, 18, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
547	{10, 14, 18, 17, 15, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0
548	{10, 14, 18, 17, 15, 23, 19, 12, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0
549	{10, 14, 18, 17, 15, 24, 23, 19, 12, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	0
550	{10, 14, 18, 17, 15, 25, 26, 19, 12, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0
551	{10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 16, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1

Appendix 1_Cycles of the system

#	Cycle	Direction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
552	{10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 16, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	1	0	1
553	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 16, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1
554	{10, 14, 18, 19, 12, 16, 13, 10}	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0
555	{10, 14, 18, 19, 12, 17, 15, 13, 10}	-1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0
556	{12, 14, 18, 17, 15, 23, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	0	0	0	0
557	{12, 14, 18, 17, 15, 24, 23, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	1	0	0	0	0
558	{12, 14, 18, 17, 15, 25, 26, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	0	0	1	1	0	0
559	{12, 14, 18, 17, 15, 25, 26, 28, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	0	0	1	1	0	1
560	{12, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1
561	{12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	0	0	0	0	1	1	1	1
562	{12, 14, 18, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
563	{12, 17, 15, 23, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	0
564	{12, 17, 15, 24, 23, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0
565	{12, 17, 15, 25, 26, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0
566	{12, 17, 15, 25, 26, 28, 19, 12}	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	1
567	{12, 17, 15, 25, 26, 28, 23, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1
568	{12, 17, 15, 25, 26, 28, 27, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1	1
569	{12, 19, 12}	-1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
570	{19, 24, 23, 19}	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0

Appendix 2: Length of cycles

This chapter shows the lengths of all identified cycles of the systemic financial crisis model. The details of this chapter are interpreted in Chapter 5.1. The background of this kind of analysis is described in Chapter 3.4.2.

The tables represents every element of the system. There are two tables for each element. One table shows the lengths of positive cycles and the second table contains the lengths of negative cycles. Each table shows the length of a cycle in the first column and in the second column the respective number of the cycle according to the list of Appendix 1.

Appendix 2_Length of cycles_Element 1_Negative cycles

Length	Cycle number
5	{107, 223}
7	{109, 202}
8	{240}
9	{40, 204}
10	{86, 149}
11	{88, 151, 181, 224, 230, 241}
12	{14, 24, 70, 92, 133, 155, 278}
13	{15, 26, 71, 84, 104, 105, 134, 147, 167, 168, 274}
14	{13, 17, 30, 58, 73, 91, 99, 121, 136, 154, 162, 195, 216, 253}
15	{37, 38, 102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 259, 276, 280}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248}
17	{8, 11, 20, 35, 44, 45, 53, 56, 68, 77, 116, 119, 131, 140, 180, 225, 251, 255, 264, 282}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 270}
19	{172, 183, 187, 208}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266}
21	{9, 54, 95, 117, 158, 268, 272}
22	{189, 210}
23	{67, 130}
24	{64, 127}

Appendix 2_Length of cycles_Element 1_Positive cycles

Length	Cycle number
2	{1}
4	{108}
5	{250}
6	{203}
7	{3, 47, 48, 110, 111}
9	{170, 184, 185, 205, 206, 239}
10	{87, 150}
11	{81, 89, 90, 144, 152, 153}
12	{23, 25, 46, 80, 101, 143, 164, 275}
13	{27, 28, 93, 103, 156, 166, 192, 194, 213, 215, 229, 281}
14	{4, 34, 41, 49, 94, 112, 157, 200, 221, 256}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 175, 196, 217, 252, 273, 277}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 179, 197, 218, 279, 283}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 267}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209}
22	{65, 128, 271}

Appendix 2_Length of cycles_Element 2_Negative cycles

Length	Cycle number
4	{434}
7	{202, 435}
8	{240}
9	{204}
10	{318, 344, 403, 412, 493, 502}
11	{181, 224, 230, 241, 414, 429, 504, 519}
12	{284, 303, 321, 336, 347, 386, 417, 437, 476, 507}
13	{286, 305, 314, 323, 332, 338, 349, 388, 399, 439, 478, 489}
14	{195, 216, 301, 308, 326, 364, 391, 407, 409, 416, 431, 454, 481, 497, 499, 506, 521}
15	{193, 201, 214, 222, 231, 233, 242, 244, 280, 365, 425, 428, 455, 515, 518}
16	{173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491}
17	{180, 225, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 382, 395, 398, 421, 423, 444, 447, 450, 472, 485, 488, 511, 513}
18	{178, 198, 219, 227, 234, 245, 257, 261, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{380, 470}
24	{374, 464}

Appendix 2_Length of cycles_Element 2_Positive cycles

Length	Cycle number
2	{2}
5	{433}
6	{203}
7	{346, 436}
8	{411, 501}
9	{170, 184, 185, 205, 206, 239, 413, 503}
10	{302, 320, 385, 475}
11	{304, 322, 387, 477}
12	{300, 319, 345, 363, 404, 415, 453, 494, 505}
13	{192, 194, 213, 215, 229, 418, 427, 430, 508, 517, 520}
14	{200, 221, 285, 306, 324, 337, 348, 389, 438, 479}
15	{175, 196, 217, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 350, 359, 381, 392, 397, 400, 440, 449, 471, 482, 487, 490}
16	{179, 197, 218, 279, 283, 290, 340, 353, 405, 408, 410, 432, 443, 495, 498, 500, 522}
17	{174, 177, 191, 212, 232, 238, 243, 249, 258, 366, 426, 456, 516}
18	{171, 182, 186, 207, 236, 247, 289, 298, 317, 335, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 269}
21	{188, 209, 370, 379, 394, 460, 469, 484}
22	{271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 3_Negative cycles

Length	Cycle number
4	{434}
5	{107}
7	{109, 202, 435}
8	{240}
9	{40, 204}
10	{86, 149, 318, 344, 403, 412, 493, 502}
11	{88, 151, 181, 224, 230, 241, 414, 429, 504, 519}
12	{14, 24, 70, 92, 133, 155, 284, 303, 321, 336, 347, 386, 417, 437, 476, 507}
13	{15, 26, 71, 84, 104, 105, 134, 147, 167, 168, 274, 286, 305, 314, 323, 332, 338, 349, 388, 399, 439, 478, 489, 523, 526, 527, 531}
14	{13, 17, 30, 58, 73, 91, 99, 121, 136, 154, 162, 195, 216, 253, 301, 308, 326, 364, 391, 407, 409, 416, 431, 454, 481, 497, 499, 506, 521}
15	{37, 38, 102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 276, 280, 365, 425, 428, 455, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 68, 77, 116, 119, 131, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 382, 395, 398, 421, 423, 444, 447, 450, 472, 485, 488, 511, 513}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 3_Positive cycles

Length	Cycle number
4	{108}
5	{433}
6	{203}
7	{3, 47, 48, 110, 111, 346, 436}
8	{411, 501}
9	{170, 184, 185, 205, 206, 239, 413, 503, 530, 534}
10	{87, 150, 302, 320, 385, 475}
11	{81, 89, 90, 144, 152, 153, 304, 322, 387, 477, 524, 525, 529, 533}
12	{23, 25, 46, 80, 101, 143, 164, 275, 300, 319, 345, 363, 404, 415, 453, 494, 505}
13	{27, 28, 93, 103, 156, 166, 192, 194, 213, 215, 229, 418, 427, 430, 508, 517, 520}
14	{4, 34, 41, 49, 94, 112, 157, 200, 221, 285, 306, 324, 337, 348, 389, 438, 479}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 175, 196, 217, 252, 273, 277, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 350, 359, 381, 392, 397, 400, 440, 449, 471, 482, 487, 490}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 179, 197, 218, 279, 283, 290, 340, 353, 405, 408, 410, 432, 443, 495, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 4_Negative cycles

Length	Cycle number
7	{109, 435}
9	{204}
15	{276}

Appendix 2_Length of cycles_Element 4_Positive cycles

Length	Cycle number
17	{254}
20	{265}

Appendix 2_Length of cycles_Element 5_Negative cycles

Length	Cycle number
10	{86, 149, 403, 412, 493, 502}
11	{88, 151, 230, 241, 414, 429, 504, 519}
12	{70, 92, 133, 155, 347, 386, 417, 437, 476, 507}
13	{71, 84, 104, 105, 134, 147, 167, 168, 349, 388, 399, 439, 478, 489, 527, 531}
14	{58, 73, 91, 99, 121, 136, 154, 162, 195, 216, 364, 391, 407, 409, 416, 431, 454, 481, 497, 499, 506, 521}
15	{102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 365, 425, 428, 455, 515, 518}
16	{72, 97, 135, 160, 190, 199, 211, 220, 237, 248, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{53, 56, 68, 77, 116, 119, 131, 140, 251, 255, 354, 357, 360, 382, 395, 398, 421, 423, 444, 447, 450, 472, 485, 488, 511, 513}
18	{82, 145, 198, 219, 234, 245, 406, 496}
19	{187, 208, 369, 393, 459, 483}
20	{57, 63, 66, 120, 126, 129, 262, 266, 362, 372, 375, 378, 452, 462, 465, 468}
21	{54, 95, 117, 158, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 5_Positive cycles

Length	Cycle number
7	{47, 48, 110, 111, 346, 436}
8	{411, 501}
9	{184, 185, 205, 206, 413, 503, 530, 534}
10	{87, 150, 385, 475}
11	{81, 89, 90, 144, 152, 153, 387, 477, 529, 533} 12
{80	, 101, 143, 164, 363, 404, 415, 453, 494, 505}
13	{93, 103, 156, 166, 192, 194, 213, 215, 418, 427, 430, 508, 517, 520}
14	{49, 94, 112, 157, 200, 221, 348, 389, 438, 479}
15	{50, 74, 78, 113, 137, 141, 196, 217, 273, 277, 350, 359, 381, 392, 397, 400, 440, 449, 471, 482, 487, 490}
16	{52, 83, 85, 106, 115, 146, 148, 169, 197, 218, 353, 405, 408, 410, 432, 443, 495, 498, 500, 522}
17	{59, 100, 122, 163, 191, 212, 232, 238, 243, 249, 366, 426, 456, 516}
18	{51, 60, 69, 79, 114, 123, 132, 142, 186, 207, 236, 247, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{235, 246}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 6_Negative cycles

Length	Cycle number
7	{109, 435}
9	{204}
15	{276}
17	{251, 255}
20	{262, 266}

Appendix 2_Length of cycles_Element 6_Positive cycles

Length	Cycle number
7	{47, 110, 346, 436}
9	{184, 205}
15	{273, 277}
17	{254}
20	{265}

Appendix 2_Length of cycles_Element 7_Negative cycles

Length	Cycle number
5	{223}
8	{240}
10	{86, 149, 412, 502}
11	{88, 151, 224, 230, 241, 414, 504}
12	{14, 24, 70, 92, 133, 155, 278, 303, 321, 386, 417, 476, 507}
13	{15, 26, 71, 134, 305, 323, 388, 478}
14	{13, 17, 30, 58, 73, 91, 121, 136, 154, 195, 216, 301, 308, 326, 364, 391, 416, 454, 481, 506}
15	{102, 165, 231, 233, 242, 244, 259, 280, 428, 518}
16	{16, 29, 72, 135, 173, 176, 190, 211, 237, 248, 307, 325, 390, 480}
17	{8, 11, 20, 35, 44, 45, 53, 56, 68, 77, 116, 119, 131, 140, 225, 282, 291, 297, 313, 331, 341, 343, 354, 360, 382, 398, 444, 450, 472, 488}
18	{82, 145, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208}
20	{12, 57, 63, 66, 120, 126, 129, 299, 362, 372, 378, 452, 462, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 7_Positive cycles

Length	Cycle number
9	{239}
12	{23, 46, 80, 143, 319, 345, 404, 494}
13	{93, 103, 156, 166, 229, 281, 418, 430, 508, 520}
14	{4, 41, 49, 112, 256, 285, 337, 348, 438}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 196, 217, 287, 309, 315, 327, 333, 339, 350, 392, 400, 440, 482, 490}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 279, 283, 290, 340, 353, 408, 410, 432, 443, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 258, 267, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 289, 317, 335, 352, 368, 384, 402, 442, 458, 474, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 295, 311, 329, 358, 371, 396, 422, 424, 448, 461, 486, 512, 514}
20	{226, 235, 246, 269}
21	{61, 75, 124, 138, 188, 209, 370, 394, 460, 484}
22	{65, 128, 271, 376, 466}

Appendix 2_Length of cycles_Element 8_Negative cycles

Length	Cycle number
5	{223}
7	{109, 435}
8	{240}
9	{204}
10	{86, 149, 412, 502}
11	{88, 151, 224, 230, 241, 414, 504}
12	{14, 24, 70, 92, 133, 155, 278, 303, 321, 386, 417, 476, 507}
13	{15, 26, 71, 134, 305, 323, 388, 478}
14	{13, 17, 30, 58, 73, 91, 121, 136, 154, 195, 216, 301, 308, 326, 364, 391, 416, 454, 481, 506}
15	{102, 165, 231, 233, 242, 244, 259, 276, 280, 428, 518}
16	{16, 29, 72, 135, 173, 176, 190, 211, 237, 248, 307, 325, 390, 480}
17	{8, 11, 20, 35, 44, 45, 53, 56, 68, 77, 116, 119, 131, 140, 225, 251, 255, 282, 291, 297, 313, 331, 341, 343, 354, 360, 382, 398, 444, 450, 472, 488}
18	{82, 145, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 378, 452, 462, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 8_Positive cycles

Length	Cycle number
7	{47, 110, 346, 436}
9	{184, 205, 239}
12	{23, 46, 80, 143, 319, 345, 404, 494}
13	{93, 103, 156, 166, 229, 281, 418, 430, 508, 520}
14	{4, 41, 49, 112, 256, 285, 337, 348, 438}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 196, 217, 273, 277, 287, 309, 315, 327, 333, 339, 350, 392, 400, 440, 482, 490}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 279, 283, 290, 340, 353, 408, 410, 432, 443, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 267, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 289, 317, 335, 352, 368, 384, 402, 442, 458, 474, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 295, 311, 329, 358, 371, 396, 422, 424, 448, 461, 486, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 394, 460, 484}
22	{65, 128, 271, 376, 466}

Appendix 2_Length of cycles_Element 9_Negative cycles

Length	Cycle number
10	{541}
12	{535, 538}
14	{99, 162}
15	{259, 425, 515}
16	{32, 97, 160, 199, 220}
17	{8, 44, 53, 116, 282, 291, 310, 328, 341, 354, 395, 421, 423, 444, 485, 511, 513}
18	{178, 198, 219, 234, 245, 261, 270}
19	{172, 183, 187, 208, 393, 483}
20	{63, 126, 372, 462}
21	{9, 54, 95, 117, 158, 272, 293, 356, 420, 446, 510}
22	{189, 210}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 9_Positive cycles

Length	Cycle number
10	{536, 537}
12	{539}
13	{93, 156, 281, 418, 508}
14	{94, 157}
15	{18, 31, 74, 137, 196, 217, 309, 327, 392, 482, 540}
16	{197, 218, 283}
17	{100, 163, 174, 177, 191, 212, 426, 516}
18	{236, 247}
19	{19, 33, 76, 96, 98, 139, 159, 161, 260, 292, 311, 329, 355, 396, 419, 422, 424, 445, 486, 509, 512, 514}
20	{226, 235, 246}
21	{75, 138, 394, 484}
22	{271, 373, 463}

Appendix 2_Length of cycles_Element 10_Negative cycles

Length	Cycle number
6	{544, 546}
9	{40, 543, 555}
10	{318, 344}
11	{181, 224, 548}
12	{14, 24, 284, 303, 321, 336, 535, 538, 549, 550}
13	{15, 26, 84, 147, 286, 305, 314, 323, 332, 338, 523, 526, 551}
14	{13, 17, 30, 301, 308, 326, 407, 409, 497, 499}
15	{37, 38, 193, 214, 231, 242, 365, 455}
16	{16, 29, 32, 97, 160, 173, 176, 288, 307, 316, 325, 334, 367, 383, 457, 473, 528, 532}
17	{8, 11, 20, 35, 44, 45, 68, 131, 180, 225, 264, 291, 294, 297, 310, 313, 328, 331, 341, 343, 382, 421, 423, 472, 511, 513}
18	{82, 145, 178, 198, 219, 227, 234, 245, 270, 406, 496}
19	{172, 183, 369, 393, 459, 483}
20	{12, 63, 66, 126, 129, 262, 266, 299, 372, 375, 378, 462, 465, 468}
21	{9, 95, 158, 268, 272, 293, 420, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 10_Positive cycles

Length	Cycle number
7	{3, 545, 547}
8	{542, 554}
9	{170}
10	{302, 320, 536, 537}
11	{81, 144, 304, 322, 524, 525}
12	{23, 25, 46, 300, 319, 345}
13	{27, 28, 192, 213, 229}
14	{4, 34, 41, 94, 157, 285, 306, 324, 337, 552, 553}
15	{5, 18, 21, 31, 36, 42, 175, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 381, 471, 540}
16	{7, 43, 83, 85, 146, 148, 179, 197, 218, 290, 340, 405, 408, 410, 495, 498, 500}
17	{59, 122, 174, 177, 232, 243, 267, 366, 456}
18	{6, 22, 39, 60, 69, 123, 132, 171, 182, 263, 289, 298, 317, 335, 368, 377, 384, 458, 467, 474}
19	{10, 19, 33, 62, 96, 98, 125, 159, 161, 228, 292, 295, 311, 329, 371, 419, 422, 424, 461, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 11_Negative cycles

Length	Cycle number
6	{544}
9	{543}
10	{318, 403, 493}
11	{224, 230, 241}
12	{14, 70, 133, 284, 303, 347, 386, 437, 476, 535}
13	{15, 71, 134, 286, 305, 314, 349, 388, 399, 439, 478, 489, 523, 527, 531}
14	{13, 17, 58, 73, 121, 136, 301, 308, 364, 391, 407, 454, 481, 497}
15	{231, 242, 365, 455}
16	{16, 72, 135, 173, 190, 211, 288, 307, 316, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{8, 11, 20, 53, 56, 68, 77, 116, 119, 131, 140, 291, 294, 297, 310, 313, 354, 357, 360, 382, 395, 398, 421, 444, 447, 450, 472, 485, 488, 511}
18	{82, 145, 234, 245, 406, 496}
19	{172, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 11_Positive cycles

Length	Cycle number
7	{3, 48, 111, 545}
8	{542}
9	{170, 185, 206}
10	{302, 385, 475, 536}
11	{81, 144, 304, 387, 477, 524, 529, 533}
12	{23, 80, 143, 300, 319, 363, 404, 453, 494}
13	{192, 213}
14	{4, 49, 94, 112, 157, 285, 306, 348, 389, 438, 479}
15	{5, 18, 21, 50, 74, 78, 113, 137, 141, 287, 296, 309, 312, 315, 350, 359, 381, 392, 397, 400, 440, 449, 471, 482, 487, 490}
16	{7, 52, 83, 115, 146, 197, 218, 290, 353, 405, 408, 443, 495, 498}
17	{59, 122, 174, 191, 212, 366, 456}
18	{6, 22, 51, 60, 69, 79, 114, 123, 132, 142, 171, 186, 207, 289, 298, 317, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 55, 62, 76, 96, 118, 125, 139, 159, 292, 295, 311, 355, 358, 371, 396, 419, 422, 445, 448, 461, 486, 509, 512}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 12_Negative cycles

Length	Cycle number
3	{569}
6	{544}
8	{556}
9	{40, 543, 555, 557, 558, 567, 568}
10	{318, 403, 493, 541, 559}
11	{181, 224, 230, 241, 548}
12	{14, 70, 133, 278, 284, 303, 336, 347, 386, 437, 476, 535, 538, 549, 550}
13	{15, 71, 84, 104, 105, 134, 147, 167, 168, 274, 286, 305, 314, 338, 349, 388, 399, 439, 478, 489, 523, 526, 527, 531, 551}
14	{13, 17, 58, 73, 99, 121, 136, 162, 253, 301, 308, 364, 391, 407, 454, 481, 497}
15	{37, 38, 193, 201, 214, 222, 231, 233, 242, 244, 259, 276, 280, 365, 455}
16	{16, 32, 72, 97, 135, 160, 173, 190, 199, 211, 220, 237, 248, 288, 307, 316, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{8, 11, 20, 44, 45, 53, 56, 68, 77, 116, 119, 131, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 341, 343, 354, 357, 360, 382, 395, 398, 421, 444, 447, 450, 472, 485, 488, 511}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 12_Positive cycles

Length	Cycle number
5	{250, 562}
6	{563}
7	{3, 48, 111, 545, 564, 565}
8	{542, 554, 566}
9	{170, 185, 206}
10	{87, 150, 302, 385, 475, 536}
11	{81, 89, 90, 144, 152, 153, 304, 387, 477, 524, 529, 533, 560, 561}
12	{23, 25, 80, 101, 143, 164, 275, 300, 319, 363, 404, 453, 494, 539}
13	{27, 28, 192, 194, 213, 215, 229, 281}
14	{4, 34, 41, 49, 94, 112, 157, 200, 221, 256, 285, 306, 337, 348, 389, 438, 479, 552, 553}
15	{5, 18, 21, 42, 50, 74, 78, 113, 137, 141, 175, 252, 273, 277, 287, 296, 309, 312, 315, 339, 342, 350, 359, 381, 392, 397, 400, 440, 449, 471, 482, 487, 490, 540}
16	{7, 43, 52, 83, 115, 146, 179, 197, 218, 279, 283, 290, 340, 353, 405, 408, 443, 495, 498}
17	{59, 122, 174, 191, 212, 232, 238, 243, 249, 254, 258, 267, 366, 456}
18	{6, 22, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 55, 62, 76, 96, 118, 125, 139, 159, 228, 260, 292, 295, 311, 355, 358, 371, 396, 419, 422, 445, 448, 461, 486, 509, 512}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 13_Negative cycles

Length	Cycle number
6	{544, 546}
9	{40, 543, 555}
10	{318, 344}
11	{181, 224, 548}
12	{14, 24, 284, 303, 321, 336, 549, 550}
13	{15, 26, 84, 147, 286, 305, 314, 323, 332, 338, 523, 526, 551}
14	{13, 17, 30, 301, 308, 326, 407, 409, 497, 499}
15	{37, 38, 193, 214, 231, 242, 365, 455}
16	{16, 29, 32, 173, 176, 288, 307, 316, 325, 334, 367, 383, 457, 473, 528, 532}
17	{8, 11, 20, 35, 44, 45, 68, 131, 180, 225, 264, 291, 294, 297, 310, 313, 328, 331, 341, 343, 382, 472}
18	{82, 145, 178, 227, 270, 406, 496}
19	{172, 183, 369, 459}
20	{12, 63, 66, 126, 129, 262, 266, 299, 372, 375, 378, 462, 465, 468}
21	{9, 268, 272, 293}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 13_Positive cycles

Length	Cycle number
7	{3, 545, 547}
8	{542, 554}
9	{170}
10	{302, 320}
11	{81, 144, 304, 322, 524, 525}
12	{23, 25, 46, 300, 319, 345}
13	{27, 28, 192, 213, 229}
14	{4, 34, 41, 285, 306, 324, 337, 552, 553}
15	{5, 18, 21, 31, 36, 42, 175, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 381, 471, 540}
16	{7, 43, 83, 85, 146, 148, 179, 290, 340, 405, 408, 410, 495, 498, 500}
17	{59, 122, 174, 177, 232, 243, 267, 366, 456}
18	{6, 22, 39, 60, 69, 123, 132, 171, 182, 263, 289, 298, 317, 335, 368, 377, 384, 458, 467, 474}
19	{10, 19, 33, 62, 125, 228, 292, 295, 311, 329, 371, 461}
20	{226, 265, 269}
21	{61, 124, 188, 209, 370, 379, 460, 469}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 14_Negative cycles

Length	Number of cycle
6	{546}
8	{556}
9	{40, 543, 555, 557, 558}
10	{344, 559}
11	{181, 548}
12	{24, 284, 321, 336, 347, 437, 535, 538, 549, 550}
13	{26, 84, 147, 286, 323, 332, 338, 349, 439, 523, 526, 527, 531, 551}
14	{13, 30, 58, 121, 253, 301, 326, 364, 409, 454, 499}
15	{37, 38, 193, 214, 259, 365, 455}
16	{29, 32, 97, 160, 176, 288, 325, 334, 351, 367, 383, 441, 457, 473, 528, 532}
17	{8, 11, 35, 44, 45, 53, 56, 68, 116, 119, 131, 180, 225, 251, 255, 264, 291, 294, 297, 328, 331, 341, 343, 354, 357, 360, 382, 423, 444, 447, 450, 472, 513}
18	{82, 145, 178, 198, 219, 227, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 14_Positive cycles

Length	Cycle number
5	{562}
7	{547}
8	{542, 554}
10	{320, 537}
11	{322, 525, 560, 561}
12	{25, 46, 300, 345, 363, 453, 539}
13	{27, 28, 229}
14	{4, 34, 41, 49, 112, 256, 285, 324, 337, 348, 438, 552, 553}
15	{5, 31, 36, 42, 50, 113, 175, 252, 287, 296, 327, 330, 333, 339, 342, 350, 359, 381, 440, 449, 471, 540}
16	{7, 43, 52, 85, 115, 148, 179, 290, 340, 353, 405, 410, 443, 495, 500}
17	{59, 122, 177, 232, 243, 254, 258, 267, 366, 456}
18	{6, 39, 51, 60, 69, 114, 123, 132, 171, 182, 186, 207, 263, 289, 298, 335, 352, 361, 368, 377, 384, 442, 451, 458, 467, 474}
19	{10, 33, 55, 62, 98, 118, 125, 161, 228, 260, 292, 295, 329, 355, 358, 371, 419, 424, 445, 448, 461, 509, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 15_Negative cycles

Length	Cycle number
8	{556}
9	{543, 555, 557, 558, 567, 568}
10	{86, 149, 412, 502, 541, 559}
11	{88, 151, 414, 429, 504, 519, 548}
12	{14, 24, 70, 92, 133, 155, 278, 284, 303, 321, 336, 347, 386, 417, 437, 476, 507, 535, 538, 549, 550}
13	{15, 26, 71, 84, 104, 105, 134, 147, 167, 168, 274, 286, 305, 314, 323, 332, 338, 349, 388, 399, 439, 478, 489, 523, 526, 527, 531, 551}
14	{17, 30, 73, 91, 99, 136, 154, 162, 195, 216, 253, 308, 326, 391, 407, 409, 416, 431, 481, 497, 499, 506, 521}
15	{37, 38, 102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 259, 276, 280, 365, 425, 428, 455, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 77, 116, 119, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 395, 398, 421, 423, 444, 447, 450, 485, 488, 511, 513}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 15_Positive cycles

Length	Cycle number
6	{563}
7	{545, 547, 564, 565}
8	{411, 501, 566}
9	{413, 503, 530, 534}
10	{87, 150, 302, 320, 385, 475, 536, 537}
11	{81, 89, 90, 144, 152, 153, 304, 322, 387, 477, 524, 525, 529, 533, 560, 561}
12	{25, 101, 164, 275, 415, 505, 539}
13	{27, 28, 93, 103, 156, 166, 192, 194, 213, 215, 281, 418, 427, 430, 508, 517, 520}
14	{4, 34, 41, 49, 94, 112, 157, 200, 221, 256, 285, 306, 324, 337, 348, 389, 438, 479, 552, 553}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 175, 196, 217, 252, 273, 277, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 350, 359, 392, 397, 400, 440, 449, 482, 487, 490, 540}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 179, 197, 218, 279, 283, 290, 340, 353, 405, 408, 410, 432, 443, 495, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 267, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 16_Negative cycles

Length	Cycle number
6	{544, 546}
11	{548}
12	{549, 550}
13	{551}
15	{365, 455}
16	{367, 457, 528, 532}
17	{68, 131, 264, 382, 472}
18	{270}
19	{369, 459}
20	{63, 66, 126, 129, 262, 266, 372, 375, 378, 462, 465, 468}
21	{268, 272}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 16_Positive cycles

Length	Cycle number
8	{542, 554}
14	{552, 553}
15	{381, 471, 540}
17	{59, 122, 267, 366, 456}
18	{60, 123, 263, 368, 377, 458, 467}
19	{62, 125, 371, 461}
20	{265, 269}
21	{61, 124, 188, 209, 370, 379, 460, 469}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 17_Negative cycles

Length	Cycle number
8	{556}
9	{543, 555, 557, 558, 567, 568}
10	{86, 149, 412, 502, 541, 559}
11	{88, 151, 414, 429, 504, 519, 548}
12	{14, 24, 70, 92, 133, 155, 278, 284, 303, 321, 336, 347, 386, 417, 437, 476, 507, 535, 538, 549, 550}
13	{15, 26, 71, 84, 104, 105, 134, 147, 167, 168, 274, 286, 305, 314, 323, 332, 338, 349, 388, 399, 439, 478, 489, 523, 526, 527, 531, 551}
14	{17, 30, 73, 91, 99, 136, 154, 162, 195, 216, 253, 308, 326, 391, 407, 409, 416, 431, 481, 497, 499, 506, 521}
15	{37, 38, 102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 259, 276, 280, 365, 425, 428, 455, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 77, 116, 119, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 395, 398, 421, 423, 444, 447, 450, 485, 488, 511, 513}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 17_Positive cycles

Length	Cycle number
6	{563}
7	{545, 547, 564, 565}
8	{411, 501, 566}
9	{413, 503, 530, 534}
10	{87, 150, 302, 320, 385, 475, 536, 537}
11	{81, 89, 90, 144, 152, 153, 304, 322, 387, 477, 524, 525, 529, 533, 560, 561}
12	{25, 101, 164, 275, 415, 505, 539}
13	{27, 28, 93, 103, 156, 166, 192, 194, 213, 215, 281, 418, 427, 430, 508, 517, 520}
14	{4, 34, 41, 49, 94, 112, 157, 200, 221, 256, 285, 306, 324, 337, 348, 389, 438, 479, 552, 553}
15	{5, 18, 21, 31, 36, 42, 50, 74, 78, 113, 137, 141, 175, 196, 217, 252, 273, 277, 287, 296, 309, 312, 315, 327, 330, 333, 339, 342, 350, 359, 392, 397, 400, 440, 449, 482, 487, 490, 540}
16	{7, 43, 52, 83, 85, 106, 115, 146, 148, 169, 179, 197, 218, 279, 283, 290, 340, 353, 405, 408, 410, 432, 443, 495, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 267, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 18_Negative cycles

Length	Cycle number
6	{546}
8	{556}
9	{40, 543, 555, 557, 558}
10	{344, 559}
11	{181, 548}
12	{24, 284, 321, 336, 347, 437, 535, 538, 549, 550}
13	{26, 84, 147, 286, 323, 332, 338, 349, 439, 523, 526, 527, 531, 551}
14	{13, 30, 58, 121, 253, 301, 326, 364, 409, 454, 499}
15	{37, 38, 193, 214, 259, 365, 455}
16	{29, 32, 97, 160, 176, 288, 325, 334, 351, 367, 383, 441, 457, 473, 528, 532}
17	{8, 11, 35, 44, 45, 53, 56, 68, 116, 119, 131, 180, 225, 251, 255, 264, 291, 294, 297, 328, 331, 341, 343, 354, 357, 360, 382, 423, 444, 447, 450, 472, 513}
18	{82, 145, 178, 198, 219, 227, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 18_Positive cycles

Length	Cycle number
5	{562}
7	{547}
8	{542, 554}
10	{320, 537}
11	{322, 525, 560, 561}
12	{25, 46, 300, 345, 363, 453, 539}
13	{27, 28, 229}
14	{4, 34, 41, 49, 112, 256, 285, 324, 337, 348, 438, 552, 553}
15	{5, 31, 36, 42, 50, 113, 175, 252, 287, 296, 327, 330, 333, 339, 342, 350, 359, 381, 440, 449, 471, 540}
16	{7, 43, 52, 85, 115, 148, 179, 290, 340, 353, 405, 410, 443, 495, 500}
17	{59, 122, 177, 232, 243, 254, 258, 267, 366, 456}
18	{6, 39, 51, 60, 69, 114, 123, 132, 171, 182, 186, 207, 263, 289, 298, 335, 352, 361, 368, 377, 384, 442, 451, 458, 467, 474}
19	{10, 33, 55, 62, 98, 118, 125, 161, 228, 260, 292, 295, 329, 355, 358, 371, 419, 424, 445, 448, 461, 509, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 19_Negative cycles

Length	Cycle number
3	{569}
8	{556}
9	{40, 555, 557, 558, 567, 568}
10	{318, 344, 403, 493, 541, 559}
11	{181, 548}
12	{278, 336, 538, 549, 550}
13	{84, 104, 105, 147, 167, 168, 274, 338, 526, 551}
14	{13, 58, 91, 99, 121, 154, 162, 253, 301, 364, 407, 409, 416, 431, 454, 497, 499, 506, 521}
15	{37, 38, 102, 165, 193, 201, 214, 222, 233, 244, 259, 276, 280, 425, 428, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 199, 220, 237, 248, 288, 307, 316, 325, 334, 351, 383, 390, 401, 441, 473, 480, 491}
17	{20, 35, 44, 45, 68, 77, 131, 140, 180, 225, 251, 255, 264, 282, 294, 310, 313, 328, 331, 341, 343, 357, 382, 395, 398, 421, 423, 447, 472, 485, 488, 511, 513}
18	{82, 145, 178, 198, 219, 227, 257, 261, 270, 406, 496}
19	{183, 369, 393, 459, 483}
20	{12, 57, 120, 262, 266, 299, 362, 375, 452, 465}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 19_Positive cycles

Length	Cycle number
4	{570}
5	{250, 562}
6	{563}
7	{564, 565}
8	{554, 566}
10	{87, 150}
11	{89, 90, 152, 153, 560, 561}
12	{23, 25, 46, 80, 101, 143, 164, 275, 300, 319, 345, 363, 404, 415, 453, 494, 505, 539}
13	{27, 28, 194, 215, 229, 281, 427, 517}
14	{34, 41, 200, 221, 256, 306, 324, 337, 389, 479, 552, 553}
15	{42, 175, 252, 273, 277, 312, 330, 339, 342, 381, 397, 471, 487, 540}
16	{43, 83, 85, 106, 146, 148, 169, 179, 279, 283, 340, 405, 408, 410, 432, 495, 498, 500, 522}
17	{100, 163, 232, 238, 243, 249, 254, 258, 267, 426, 516}
18	{6, 22, 39, 51, 69, 79, 114, 132, 142, 182, 236, 247, 263, 289, 298, 317, 335, 352, 361, 384, 402, 442, 451, 474, 492}
19	{10, 19, 33, 55, 76, 96, 98, 118, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 396, 419, 422, 424, 445, 448, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 20_Negative cycles

Length	Cycle number
5	{107}
7	{202}
10	{86, 403, 412}
11	{88, 230, 414, 429}
12	{70, 92, 347, 386, 417}
13	{71, 84, 104, 105, 274, 349, 388, 399, 527}
14	{58, 73, 91, 99, 195, 364, 391, 407, 409, 416, 431}
15	{102, 193, 201, 231, 233, 365, 425, 428}
16	{72, 97, 190, 199, 237, 351, 367, 383, 390, 401, 528}
17	{53, 56, 68, 77, 251, 282, 354, 357, 360, 382, 395, 398, 421, 423}
18	{82, 198, 234, 257, 406}
19	{187, 369, 393}
20	{57, 63, 66, 262, 362, 372, 375, 378}
21	{54, 95, 268, 356, 420}
22	{189}
23	{67, 380}
24	{64, 374}

Appendix 2_Length of cycles_Element 20_Positive cycles

Length	Cycle number
5	{433}
7	{47, 48, 346}
8	{411}
9	{184, 185, 239, 413, 530}
10	{87, 385}
11	{81, 89, 90, 387, 529}
12	{80, 101, 363, 404, 415}
13	{93, 103, 192, 194, 418, 427, 430}
14	{49, 94, 200, 348, 389}
15	{50, 74, 78, 196, 252, 273, 350, 359, 381, 392, 397, 400}
16	{52, 83, 85, 106, 197, 279, 353, 405, 408, 410, 432}
17	{59, 100, 191, 232, 238, 366, 426}
18	{51, 60, 69, 79, 186, 236, 263, 352, 361, 368, 377, 384, 402}
19	{55, 62, 76, 96, 98, 260, 355, 358, 371, 396, 419, 422, 424}
20	{235}
21	{61, 75, 188, 370, 379, 394}
22	{65, 271, 373, 376}

Appendix 2_Length of cycles_Element 21_Negative cycles

Length	Cycle number
4	{434}
5	{107}
7	{202}
8	{240}
13	{274}
14	{253}
15	{280}
17	{264, 282}
18	{257, 261}
21	{268, 272}

Appendix 2_Length of cycles_Element 21_Positive cycles

Length	Cycle number
4	{108}
5	{433}
6	{203}
9	{239}
12	{275}
15	{252}
16	{279, 283}
17	{258}
18	{263}
19	{260}
20	{269}
22	{271}

Appendix 2_Length of cycles_Element 22_Negative cycles

Length	Cycle number
7	{109, 435}
9	{204}
10	{149, 493, 502}
11	{151, 241, 504, 519}
12	{133, 155, 437, 476, 507}
13	{134, 147, 167, 168, 439, 478, 489, 531}
14	{121, 136, 154, 162, 216, 454, 481, 497, 499, 506, 521}
15	{165, 214, 222, 242, 244, 276, 455, 515, 518}
16	{135, 160, 211, 220, 248, 441, 457, 473, 480, 491, 532}
17	{116, 119, 131, 140, 255, 444, 447, 450, 472, 485, 488, 511, 513}
18	{145, 219, 245, 496}
19	{208, 459, 483}
20	{120, 126, 129, 266, 452, 462, 465, 468}
21	{117, 158, 446, 510}
22	{210}
23	{130, 470}
24	{127, 464}

Appendix 2_Length of cycles_Element 22_Positive cycles

Length	Cycle number
7	{110, 111, 436}
8	{501}
9	{205, 206, 503, 534}
10	{150, 475}
11	{144, 152, 153, 477, 533}
12	{143, 164, 453, 494, 505}
13	{156, 166, 213, 215, 508, 517, 520}
14	{112, 157, 221, 438, 479}
15	{113, 137, 141, 217, 277, 440, 449, 471, 482, 487, 490}
16	{115, 146, 148, 169, 218, 443, 495, 498, 500, 522}
17	{122, 163, 212, 243, 249, 254, 456, 516}
18	{114, 123, 132, 142, 207, 247, 442, 451, 458, 467, 474, 492}
19	{118, 125, 139, 159, 161, 445, 448, 461, 486, 509, 512, 514}
20	{246, 265}
21	{124, 138, 209, 460, 469, 484}
22	{128, 463, 466}

Appendix 2_Length of cycles_Element 23_Negative cycles

Length	Cycle number
5	{223}
7	{202}
8	{240, 556}
9	{204, 557, 567}
10	{86, 149, 318, 344, 403, 412, 493, 502}
11	{88, 151, 181, 224, 230, 241, 414, 429, 504, 519, 548}
12	{14, 24, 70, 133, 278, 284, 303, 321, 336, 347, 386, 437, 476, 549}
13	{15, 26, 71, 104, 134, 167, 274, 286, 305, 314, 323, 332, 338, 349, 388, 399, 439, 478, 489}
14	{13, 58, 91, 121, 154, 195, 216, 253, 301, 364, 407, 409, 416, 431, 454, 497, 499, 506, 521}
15	{37, 102, 165, 193, 201, 214, 222, 231, 233, 242, 244, 259, 276, 280, 365, 425, 428, 455, 515, 518}
16	{16, 29, 72, 135, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491}
17	{11, 20, 35, 45, 56, 68, 77, 119, 131, 140, 180, 225, 251, 255, 264, 282, 294, 297, 310, 313, 328, 331, 343, 357, 360, 382, 395, 398, 421, 423, 447, 450, 472, 485, 488, 511, 513}
18	{82, 145, 178, 198, 219, 227, 234, 245, 257, 261, 270, 406, 496}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 66, 120, 129, 262, 266, 299, 362, 375, 378, 452, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 23_Positive cycles

Length	Cycle number
4	{570}
5	{250}
6	{203, 563}
7	{564}
8	{411, 501}
9	{170, 184, 185, 205, 206, 239, 413, 503}
10	{87, 150, 302, 320, 385, 475}
11	{89, 152, 304, 322, 387, 477, 560}
12	{23, 25, 46, 80, 143, 275, 300, 319, 345, 363, 404, 415, 453, 494, 505}
13	{27, 103, 166, 192, 194, 213, 215, 229, 281, 427, 430, 517, 520}
14	{4, 41, 49, 112, 200, 221, 256, 285, 306, 324, 337, 348, 389, 438, 479, 552}
15	{5, 21, 36, 42, 50, 78, 113, 141, 175, 196, 217, 252, 273, 277, 287, 296, 312, 315, 330, 333, 339, 342, 350, 359, 381, 397, 400, 440, 449, 471, 487, 490}
16	{83, 85, 106, 146, 148, 169, 179, 197, 218, 279, 283, 405, 408, 410, 432, 495, 498, 500, 522}
17	{59, 100, 122, 163, 174, 177, 191, 212, 232, 238, 243, 249, 254, 258, 267, 366, 426, 456, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 368, 377, 384, 402, 442, 451, 458, 467, 474, 492}
19	{10, 19, 33, 55, 76, 96, 98, 118, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 396, 419, 422, 424, 445, 448, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 24_Negative cycles

Length	Cycle number
9	{557}
10	{318, 344, 403, 493}
11	{88, 151, 414, 504}
12	{549}
13	{15, 26, 71, 134, 286, 305, 323, 338, 349, 388, 439, 478}
14	{13, 58, 91, 121, 154, 301, 364, 407, 409, 416, 431, 454, 497, 499, 506, 521}
15	{102, 165, 425, 428, 515, 518}
16	{16, 29, 72, 135, 288, 307, 316, 325, 334, 351, 367, 383, 390, 401, 441, 457, 473, 480, 491}
17	{20, 35, 68, 77, 131, 140, 294, 310, 313, 328, 331, 357, 382, 395, 398, 421, 423, 447, 472, 485, 488, 511, 513}
18	{82, 145, 406, 496}
19	{369, 393, 459, 483}
20	{12, 57, 120, 299, 362, 375, 452, 465}
21	{9, 54, 95, 117, 158, 293, 356, 420, 446, 510}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 24_Positive cycles

Length	Cycle number
4	{570}
7	{564}
9	{413, 503}
11	{89, 152, 304, 322, 387, 477}
12	{23, 46, 80, 143, 300, 319, 345, 363, 404, 415, 453, 494, 505}
13	{27, 427, 517}
14	{306, 324, 389, 479}
15	{5, 42, 50, 113, 287, 312, 330, 339, 350, 381, 397, 440, 471, 487}
16	{83, 85, 106, 146, 148, 169, 405, 408, 410, 432, 495, 498, 500, 522}
17	{100, 163, 426, 516}
18	{6, 22, 39, 51, 60, 69, 79, 114, 123, 132, 142, 289, 298, 317, 335, 352, 361, 368, 384, 402, 442, 451, 458, 474, 492}
19	{10, 19, 33, 55, 76, 96, 98, 118, 139, 159, 161, 292, 295, 311, 329, 355, 358, 396, 419, 422, 424, 445, 448, 486, 509, 512, 514}
21	{61, 75, 124, 138, 370, 379, 394, 460, 469, 484}
22	{65, 128, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 25_Negative cycles

Length	Cycle number
9	{558, 567, 568}
10	{541, 559}
11	{429, 519}
12	{92, 155, 278, 417, 507, 535, 538, 550}
13	{104, 105, 167, 168, 274, 314, 332, 399, 489, 523, 526, 527, 531, 551}
14	{17, 30, 73, 91, 99, 136, 154, 162, 195, 216, 253, 308, 326, 391, 416, 431, 481, 506, 521}
15	{37, 38, 102, 165, 201, 222, 233, 244, 259, 276, 280, 425, 428, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 390, 401, 441, 480, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 77, 116, 119, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 395, 398, 421, 423, 444, 447, 450, 485, 488, 511, 513}
18	{178, 198, 219, 227, 234, 245, 257, 261, 270}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 25_Positive cycles

Length	Cycle number
7	{565}
8	{566}
9	{530, 534}
10	{536, 537}
11	{90, 153, 524, 525, 529, 533, 560, 561}
12	{101, 164, 275, 415, 505, 539}
13	{28, 93, 103, 156, 166, 194, 215, 281, 418, 427, 430, 508, 517, 520}
14	{34, 94, 157, 200, 221, 256, 306, 324, 389, 479, 552, 553}
15	{18, 21, 31, 36, 74, 78, 137, 141, 175, 196, 217, 252, 273, 277, 296, 309, 312, 315, 327, 330, 333, 342, 359, 392, 397, 400, 449, 482, 487, 490, 540}
16	{7, 43, 52, 106, 115, 169, 179, 197, 218, 279, 283, 290, 340, 353, 432, 443, 522}
17	{100, 163, 174, 177, 191, 212, 238, 249, 254, 258, 267, 426, 516}
18	{6, 22, 39, 51, 79, 114, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 377, 402, 442, 451, 467, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 26_Negative cycles

Length	Cycle number
9	{558, 567, 568}
10	{541, 559}
11	{429, 519}
12	{92, 155, 278, 417, 507, 535, 538, 550}
13	{104, 105, 167, 168, 274, 314, 332, 399, 489, 523, 526, 527, 531, 551}
14	{17, 30, 73, 91, 99, 136, 154, 162, 195, 216, 253, 308, 326, 391, 416, 431, 481, 506, 521}
15	{37, 38, 102, 165, 201, 222, 233, 244, 259, 276, 280, 425, 428, 515, 518}
16	{16, 29, 32, 72, 97, 135, 160, 173, 176, 190, 199, 211, 220, 237, 248, 288, 307, 316, 325, 334, 351, 390, 401, 441, 480, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 77, 116, 119, 140, 180, 225, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 395, 398, 421, 423, 444, 447, 450, 485, 488, 511, 513}
18	{178, 198, 219, 227, 234, 245, 257, 261, 270}
19	{172, 183, 187, 208, 369, 393, 459, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 26_Positive cycles

Length	Cycle number
7	{565}
8	{566}
9	{530, 534}
10	{536, 537}
11	{90, 153, 524, 525, 529, 533, 560, 561}
12	{101, 164, 275, 415, 505, 539}
13	{28, 93, 103, 156, 166, 194, 215, 281, 418, 427, 430, 508, 517, 520}
14	{34, 94, 157, 200, 221, 256, 306, 324, 389, 479, 552, 553}
15	{18, 21, 31, 36, 74, 78, 137, 141, 175, 196, 217, 252, 273, 277, 296, 309, 312, 315, 327, 330, 333, 342, 359, 392, 397, 400, 449, 482, 487, 490, 540}
16	{7, 43, 52, 106, 115, 169, 179, 197, 218, 279, 283, 290, 340, 353, 432, 443, 522}
17	{100, 163, 174, 177, 191, 212, 238, 249, 254, 258, 267, 426, 516}
18	{6, 22, 39, 51, 79, 114, 142, 171, 182, 186, 207, 236, 247, 263, 289, 298, 317, 335, 352, 361, 377, 402, 442, 451, 467, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{61, 75, 124, 138, 188, 209, 370, 379, 394, 460, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 2_Length of cycles_Element 27_Negative cycles

Length	Cycle number
9	{568}
10	{541}
13	{105, 168}
14	{99, 162, 431, 521}
15	{38, 201, 222, 425, 515}
16	{32, 199, 220, 316, 334, 401, 491}
17	{180, 310, 328, 395, 485}
18	{178}
20	{12, 57, 120, 299, 362, 452}
21	{9, 54, 117, 293, 356, 446}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 27_Positive cycles

Length	Cycle number
11	{561}
12	{539}
14	{553}
15	{540}
16	{106, 169, 432, 522}
17	{100, 163, 238, 249, 426, 516}
18	{22, 39, 79, 142, 236, 247, 298, 317, 335, 361, 402, 451, 492}
19	{19, 33, 76, 139, 228, 292, 311, 329, 355, 396, 445, 486}
20	{226}
21	{379, 469}
22	{373, 463}

Appendix 2_Length of cycles_Element 28_Negative cycles

Length	Cycle number
9	{567, 568}
10	{541, 559}
11	{429, 519}
12	{92, 155, 278, 417, 507, 535, 538}
13	{104, 105, 167, 168, 274, 314, 332, 399, 489, 523, 526, 527, 531, 551}
14	{17, 30, 73, 99, 136, 162, 195, 216, 253, 308, 326, 391, 431, 481, 521}
15	{37, 38, 102, 165, 201, 222, 259, 276, 280, 425, 428, 515, 518}
16	{32, 97, 160, 173, 176, 190, 199, 211, 220, 237, 248, 316, 334, 401, 491, 528, 532}
17	{8, 11, 20, 35, 44, 45, 53, 56, 77, 116, 119, 140, 180, 251, 255, 264, 282, 291, 294, 297, 310, 313, 328, 331, 341, 343, 354, 357, 360, 395, 398, 421, 423, 444, 447, 450, 485, 488, 511, 513}
18	{178, 198, 219, 227, 234, 245, 257, 261, 270}
19	{172, 183, 187, 208, 393, 483}
20	{12, 57, 63, 66, 120, 126, 129, 262, 266, 299, 362, 372, 375, 378, 452, 462, 465, 468}
21	{9, 54, 95, 117, 158, 268, 272, 293, 356, 420, 446, 510}
22	{189, 210}
23	{67, 130, 380, 470}
24	{64, 127, 374, 464}

Appendix 2_Length of cycles_Element 28_Positive cycles

Length	Cycle number
8	{566}
9	{530, 534}
10	{536, 537}
11	{524, 525, 529, 533, 560, 561}
12	{101, 164, 275, 539}
13	{93, 103, 156, 166, 281, 418, 427, 430, 508, 517, 520}
14	{34, 94, 157, 200, 221, 256, 552, 553}
15	{18, 21, 31, 36, 74, 78, 137, 141, 196, 217, 252, 273, 277, 296, 309, 312, 315, 327, 330, 333, 342, 359, 392, 397, 400, 449, 482, 487, 490, 540}
16	{7, 43, 52, 106, 115, 169, 179, 197, 218, 279, 283, 290, 340, 353, 432, 443, 522}
17	{100, 163, 174, 177, 191, 212, 238, 249, 254, 258, 267, 426, 516}
18	{22, 39, 79, 142, 171, 182, 186, 207, 236, 247, 263, 298, 317, 335, 361, 377, 402, 451, 467, 492}
19	{10, 19, 33, 55, 62, 76, 96, 98, 118, 125, 139, 159, 161, 228, 260, 292, 295, 311, 329, 355, 358, 371, 396, 419, 422, 424, 445, 448, 461, 486, 509, 512, 514}
20	{226, 235, 246, 265, 269}
21	{75, 138, 188, 209, 379, 394, 469, 484}
22	{65, 128, 271, 373, 376, 463, 466}

Appendix 3: Involved elements of cycles

This chapter shows the consolidated involvement of elements in identified cycles of the systemic financial crisis model. The details of this chapter are interpreted in Chapter 5.1. The background of this kind of analysis is described in Chapter 3.4.2.

The tables represents every element of the system. The tables contain four columns. The elements of the system are listed in the first column. The second column counts the overall involvement of elements. The third and fourth columns distinguish between positive and negative cycles.

Appendix 3_Involved elements of cycles_Element 1

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	282	148	134
Asset supply	91	46	45
Asset price	273	143	130
Expected risk of asset	5	2	3
Expected return of asset	180	96	84
Asset risk-return ratio	15	8	7
Market risk-return ratio	198	101	97
Attractiveness of asset	213	109	104
General rate of interest	73	37	36
Costs of new loans	139	74	65
Attractiveness of financed investments	129	70	59
New loans for investments	230	120	110
Creditworthiness of financed investors	119	62	57
Payments for new loans	143	71	72
Risk of debt default	246	128	118
Loans for investments	35	17	18
Asset cash flow	246	128	118
Payments for loans	143	71	72
Liquidity of banks	170	88	82
Euphoria	102	54	48
Short sale	24	12	12
Risk of misbehaviour	95	50	45
Risk of contagion	228	119	109
Creditworthiness of banks	84	47	37
Uncertainty	196	98	98
Interbank lending	196	98	98
Foreign exchange rate	40	18	22
Money supply	176	87	89

Appendix 3_Involved elements of cycles_Element 2

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	91	46	45
Asset supply	331	167	164
Asset price	330	166	164
Expected risk of asset	2	0	2
Expected return of asset	228	116	112
Asset risk-return ratio	6	4	2
Market risk-return ratio	191	98	93
Attractiveness of asset	197	102	95
General rate of interest	82	41	41
Costs of new loans	174	87	87
Attractiveness of financed investments	198	99	99
New loans for investments	254	127	127
Creditworthiness of financed investors	150	75	75
Payments for new loans	180	90	90
Risk of debt default	292	146	146
Loans for investments	44	22	22
Asset cash flow	292	146	146
Payments for loans	180	90	90
Liquidity of banks	194	97	97
Euphoria	123	63	60
Short sale	18	9	9
Risk of misbehaviour	116	58	58
Risk of contagion	301	151	150
Creditworthiness of banks	162	81	81
Uncertainty	220	110	110
Interbank lending	220	110	110
Foreign exchange rate	56	28	28
Money supply	192	96	96

Appendix 3_Involved elements of cycles_Element 3

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	273	143	130
Asset supply	330	166	164
Asset price	524	269	255
Expected risk of asset	6	2	4
Expected return of asset	362	188	174
Asset risk-return ratio	18	10	8
Market risk-return ratio	320	166	154
Attractiveness of asset	338	176	162
General rate of interest	120	61	59
Costs of new loans	273	140	133
Attractiveness of financed investments	305	157	148
New loans for investments	408	207	201
Creditworthiness of financed investors	237	120	117
Payments for new loans	286	140	146
Risk of debt default	468	239	229
Loans for investments	71	34	37
Asset cash flow	468	239	229
Payments for loans	286	140	146
Liquidity of banks	310	157	153
Euphoria	194	101	93
Short sale	26	13	13
Risk of misbehaviour	187	96	91
Risk of contagion	430	220	210
Creditworthiness of banks	246	128	118
Uncertainty	354	177	177
Interbank lending	354	177	177
Foreign exchange rate	84	40	44
Money supply	312	155	157

Appendix 3_Involved elements of cycles_Element 4

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	5	2	3
Asset supply	2	0	2
Asset price	6	2	4
Expected risk of asset	6	2	4
Expected return of asset	0	0	0
Asset risk-return ratio	6	2	4
Market risk-return ratio	0	0	0
Attractiveness of asset	6	2	4
General rate of interest	0	0	0
Costs of new loans	1	1	0
Attractiveness of financed investments	0	0	0
New loans for investments	3	2	1
Creditworthiness of financed investors	1	1	0
Payments for new loans	2	2	0
Risk of debt default	3	2	1
Loans for investments	1	1	0
Asset cash flow	3	2	1
Payments for loans	2	2	0
Liquidity of banks	3	2	1
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	6	2	4
Risk of contagion	4	2	2
Creditworthiness of banks	0	0	0
Uncertainty	3	2	1
Interbank lending	3	2	1
Foreign exchange rate	0	0	0
Money supply	3	2	1

Appendix 3_Involved elements of cycles_Element 5

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	180	96	84
Asset supply	228	116	112
Asset price	362	188	174
Expected risk of asset	0	0	0
Expected return of asset	362	188	174
Asset risk-return ratio	12	8	4
Market risk-return ratio	222	116	106
Attractiveness of asset	234	124	110
General rate of interest	90	46	44
Costs of new loans	136	70	66
Attractiveness of financed investments	240	124	116
New loans for investments	288	146	142
Creditworthiness of financed investors	100	50	50
Payments for new loans	176	84	92
Risk of debt default	332	170	162
Loans for investments	64	30	34
Asset cash flow	332	170	162
Payments for loans	176	84	92
Liquidity of banks	210	106	104
Euphoria	181	94	87
Short sale	0	0	0
Risk of misbehaviour	181	94	87
Risk of contagion	300	154	146
Creditworthiness of banks	188	98	90
Uncertainty	244	122	122
Interbank lending	244	122	122
Foreign exchange rate	60	28	32
Money supply	214	106	108

Appendix 3_Involved elements of cycles_Element 6

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	15	8	7
Asset supply	6	4	2
Asset price	18	10	8
Expected risk of asset	6	2	4
Expected return of asset	12	8	4
Asset risk-return ratio	18	10	8
Market risk-return ratio	0	0	0
Attractiveness of asset	18	10	8
General rate of interest	0	0	0
Costs of new loans	3	1	2
Attractiveness of financed investments	0	0	0
New loans for investments	9	4	5
Creditworthiness of financed investors	3	1	2
Payments for new loans	6	2	4
Risk of debt default	9	4	5
Loans for investments	3	1	2
Asset cash flow	9	4	5
Payments for loans	6	2	4
Liquidity of banks	9	4	5
Euphoria	6	4	2
Short sale	0	0	0
Risk of misbehaviour	12	6	6
Risk of contagion	12	6	6
Creditworthiness of banks	0	0	0
Uncertainty	9	4	5
Interbank lending	9	4	5
Foreign exchange rate	0	0	0
Money supply	9	4	5

Appendix 3_Involved elements of cycles_Element 7

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	198	101	97
Asset supply	191	98	93
Asset price	320	166	154
Expected risk of asset	0	0	0
Expected return of asset	222	116	106
Asset risk-return ratio	0	0	0
Market risk-return ratio	327	169	158
Attractiveness of asset	327	169	158
General rate of interest	90	51	39
Costs of new loans	174	96	78
Attractiveness of financed investments	207	104	103
New loans for investments	254	131	123
Creditworthiness of financed investors	154	82	72
Payments for new loans	189	102	87
Risk of debt default	302	159	143
Loans for investments	50	25	25
Asset cash flow	302	159	143
Payments for loans	189	102	87
Liquidity of banks	185	103	82
Euphoria	118	62	56
Short sale	14	7	7
Risk of misbehaviour	111	58	53
Risk of contagion	279	145	134
Creditworthiness of banks	162	88	74
Uncertainty	234	121	113
Interbank lending	234	121	113
Foreign exchange rate	50	30	20
Money supply	209	111	98

Appendix 3_Involved elements of cycles_Element 8

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	213	109	104
Asset supply	197	102	95
Asset price	338	176	162
Expected risk of asset	6	2	4
Expected return of asset	234	124	110
Asset risk-return ratio	18	10	8
Market risk-return ratio	327	169	158
Attractiveness of asset	345	179	166
General rate of interest	90	51	39
Costs of new loans	177	97	80
Attractiveness of financed investments	207	104	103
New loans for investments	263	135	128
Creditworthiness of financed investors	157	83	74
Payments for new loans	195	104	91
Risk of debt default	311	163	148
Loans for investments	53	26	27
Asset cash flow	311	163	148
Payments for loans	195	104	91
Liquidity of banks	194	107	87
Euphoria	124	66	58
Short sale	14	7	7
Risk of misbehaviour	123	64	59
Risk of contagion	291	151	140
Creditworthiness of banks	162	88	74
Uncertainty	243	125	118
Interbank lending	243	125	118
Foreign exchange rate	50	30	20
Money supply	218	115	103

Appendix 3_Involved elements of cycles_Element 9

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	73	37	36
Asset supply	82	41	41
Asset price	120	61	59
Expected risk of asset	0	0	0
Expected return of asset	90	46	44
Asset risk-return ratio	0	0	0
Market risk-return ratio	90	51	39
Attractiveness of asset	90	51	39
General rate of interest	130	66	64
Costs of new loans	80	38	42
Attractiveness of financed investments	74	35	39
New loans for investments	105	46	59
Creditworthiness of financed investors	40	16	24
Payments for new loans	77	28	49
Risk of debt default	130	66	64
Loans for investments	16	4	12
Asset cash flow	130	66	64
Payments for loans	77	28	49
Liquidity of banks	88	42	46
Euphoria	48	25	23
Short sale	6	3	3
Risk of misbehaviour	45	23	22
Risk of contagion	92	48	44
Creditworthiness of banks	57	31	26
Uncertainty	130	66	64
Interbank lending	130	66	64
Foreign exchange rate	45	22	23
Money supply	130	66	64

Appendix 3_Involved elements of cycles_Element 10

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	139	74	65
Asset supply	174	87	87
Asset price	273	140	133
Expected risk of asset	1	1	0
Expected return of asset	136	70	66
Asset risk-return ratio	3	1	2
Market risk-return ratio	174	96	78
Attractiveness of asset	177	97	80
General rate of interest	80	38	42
Costs of new loans	294	150	144
Attractiveness of financed investments	181	94	87
New loans for investments	248	124	124
Creditworthiness of financed investors	254	128	126
Payments for new loans	233	114	119
Risk of debt default	269	138	131
Loans for investments	84	40	44
Asset cash flow	269	138	131
Payments for loans	233	114	119
Liquidity of banks	190	95	95
Euphoria	71	37	34
Short sale	6	3	3
Risk of misbehaviour	69	36	33
Risk of contagion	234	121	113
Creditworthiness of banks	143	76	67
Uncertainty	189	94	95
Interbank lending	189	94	95
Foreign exchange rate	38	18	20
Money supply	170	84	86

Appendix 3_Involved elements of cycles_Element 11

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	129	70	59
Asset supply	198	99	99
Asset price	305	157	148
Expected risk of asset	0	0	0
Expected return of asset	240	124	116
Asset risk-return ratio	0	0	0
Market risk-return ratio	207	104	103
Attractiveness of asset	207	104	103
General rate of interest	74	35	39
Costs of new loans	181	94	87
Attractiveness of financed investments	311	160	151
New loans for investments	311	160	151
Creditworthiness of financed investors	155	79	76
Payments for new loans	182	88	94
Risk of debt default	276	142	134
Loans for investments	64	31	33
Asset cash flow	276	142	134
Payments for loans	182	88	94
Liquidity of banks	156	79	77
Euphoria	120	62	58
Short sale	0	0	0
Risk of misbehaviour	120	62	58
Risk of contagion	258	131	127
Creditworthiness of banks	180	92	88
Uncertainty	202	101	101
Interbank lending	202	101	101
Foreign exchange rate	48	22	26
Money supply	178	88	90

Appendix 3_Involved elements of cycles_Element 12

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	230	120	110
Asset supply	254	127	127
Asset price	408	207	201
Expected risk of asset	3	2	1
Expected return of asset	288	146	142
Asset risk-return ratio	9	4	5
Market risk-return ratio	254	131	123
Attractiveness of asset	263	135	128
General rate of interest	105	46	59
Costs of new loans	248	124	124
Attractiveness of financed investments	311	160	151
New loans for investments	447	226	221
Creditworthiness of financed investors	215	107	108
Payments for new loans	268	127	141
Risk of debt default	405	204	201
Loans for investments	83	40	43
Asset cash flow	405	204	201
Payments for loans	268	127	141
Liquidity of banks	292	145	147
Euphoria	153	78	75
Short sale	18	9	9
Risk of misbehaviour	147	75	72
Risk of contagion	355	181	174
Creditworthiness of banks	189	98	91
Uncertainty	306	149	157
Interbank lending	306	149	157
Foreign exchange rate	72	32	40
Money supply	270	129	141

Appendix 3_Involved elements of cycles_Element 13

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	119	62	57
Asset supply	150	75	75
Asset price	237	120	117
Expected risk of asset	1	1	0
Expected return of asset	100	50	50
Asset risk-return ratio	3	1	2
Market risk-return ratio	154	82	72
Attractiveness of asset	157	83	74
General rate of interest	40	16	24
Costs of new loans	254	128	126
Attractiveness of financed investments	155	79	76
New loans for investments	215	107	108
Creditworthiness of financed investors	254	128	126
Payments for new loans	206	101	105
Risk of debt default	229	116	113
Loans for investments	84	40	44
Asset cash flow	229	116	113
Payments for loans	206	101	105
Liquidity of banks	159	79	80
Euphoria	53	27	26
Short sale	6	3	3
Risk of misbehaviour	51	26	25
Risk of contagion	202	103	99
Creditworthiness of banks	119	62	57
Uncertainty	149	72	77
Interbank lending	149	72	77
Foreign exchange rate	38	18	20
Money supply	130	62	68

Appendix 3_Involved elements of cycles_Element 14

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	143	71	72
Asset supply	180	90	90
Asset price	286	140	146
Expected risk of asset	2	2	0
Expected return of asset	176	84	92
Asset risk-return ratio	6	2	4
Market risk-return ratio	189	102	87
Attractiveness of asset	195	104	91
General rate of interest	77	28	49
Costs of new loans	233	114	119
Attractiveness of financed investments	182	88	94
New loans for investments	268	127	141
Creditworthiness of financed investors	206	101	105
Payments for new loans	314	153	161
Risk of debt default	289	142	147
Loans for investments	83	40	43
Asset cash flow	289	142	147
Payments for loans	314	153	161
Liquidity of banks	212	102	110
Euphoria	94	46	48
Short sale	12	6	6
Risk of misbehaviour	90	44	46
Risk of contagion	252	127	125
Creditworthiness of banks	150	77	73
Uncertainty	214	101	113
Interbank lending	214	101	113
Foreign exchange rate	46	20	26
Money supply	191	88	103

Appendix 3_Involved elements of cycles_Element 15

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	246	128	118
Asset supply	292	146	146
Asset price	468	239	229
Expected risk of asset	3	2	1
Expected return of asset	332	170	162
Asset risk-return ratio	9	4	5
Market risk-return ratio	302	159	143
Attractiveness of asset	311	163	148
General rate of interest	130	66	64
Costs of new loans	269	138	131
Attractiveness of financed investments	276	142	134
New loans for investments	405	204	201
Creditworthiness of financed investors	229	116	113
Payments for new loans	289	142	147
Risk of debt default	503	256	247
Loans for investments	74	36	38
Asset cash flow	503	256	247
Payments for loans	289	142	147
Liquidity of banks	309	156	153
Euphoria	175	90	85
Short sale	18	9	9
Risk of misbehaviour	169	87	82
Risk of contagion	403	206	197
Creditworthiness of banks	222	116	106
Uncertainty	379	190	189
Interbank lending	379	190	189
Foreign exchange rate	90	44	46
Money supply	334	167	167

Appendix 3_Involved elements of cycles_Element 16

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	35	17	18
Asset supply	44	22	22
Asset price	71	34	37
Expected risk of asset	1	1	0
Expected return of asset	64	30	34
Asset risk-return ratio	3	1	2
Market risk-return ratio	50	25	25
Attractiveness of asset	53	26	27
General rate of interest	16	4	12
Costs of new loans	84	40	44
Attractiveness of financed investments	64	31	33
New loans for investments	83	40	43
Creditworthiness of financed investors	84	40	44
Payments for new loans	83	40	43
Risk of debt default	74	36	38
Loans for investments	84	40	44
Asset cash flow	74	36	38
Payments for loans	83	40	43
Liquidity of banks	49	23	26
Euphoria	35	17	18
Short sale	6	3	3
Risk of misbehaviour	33	16	17
Risk of contagion	66	32	34
Creditworthiness of banks	37	18	19
Uncertainty	60	28	32
Interbank lending	60	28	32
Foreign exchange rate	14	6	8
Money supply	53	24	29

Appendix 3_Involved elements of cycles_Element 17

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	246	128	118
Asset supply	292	146	146
Asset price	468	239	229
Expected risk of asset	3	2	1
Expected return of asset	332	170	162
Asset risk-return ratio	9	4	5
Market risk-return ratio	302	159	143
Attractiveness of asset	311	163	148
General rate of interest	130	66	64
Costs of new loans	269	138	131
Attractiveness of financed investments	276	142	134
New loans for investments	405	204	201
Creditworthiness of financed investors	229	116	113
Payments for new loans	289	142	147
Risk of debt default	503	256	247
Loans for investments	74	36	38
Asset cash flow	503	256	247
Payments for loans	289	142	147
Liquidity of banks	309	156	153
Euphoria	175	90	85
Short sale	18	9	9
Risk of misbehaviour	169	87	82
Risk of contagion	403	206	197
Creditworthiness of banks	222	116	106
Uncertainty	379	190	189
Interbank lending	379	190	189
Foreign exchange rate	90	44	46
Money supply	334	167	167

Appendix 3_Involved elements of cycles_Element 18

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	143	71	72
Asset supply	180	90	90
Asset price	286	140	146
Expected risk of asset	2	2	0
Expected return of asset	176	84	92
Asset risk-return ratio	6	2	4
Market risk-return ratio	189	102	87
Attractiveness of asset	195	104	91
General rate of interest	77	28	49
Costs of new loans	233	114	119
Attractiveness of financed investments	182	88	94
New loans for investments	268	127	141
Creditworthiness of financed investors	206	101	105
Payments for new loans	314	153	161
Risk of debt default	289	142	147
Loans for investments	83	40	43
Asset cash flow	289	142	147
Payments for loans	314	153	161
Liquidity of banks	212	102	110
Euphoria	94	46	48
Short sale	12	6	6
Risk of misbehaviour	90	44	46
Risk of contagion	252	127	125
Creditworthiness of banks	150	77	73
Uncertainty	214	101	113
Interbank lending	214	101	113
Foreign exchange rate	46	20	26
Money supply	191	88	103

Appendix 3_Involved elements of cycles_Element 19

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	170	88	82
Asset supply	194	97	97
Asset price	310	157	153
Expected risk of asset	3	2	1
Expected return of asset	210	106	104
Asset risk-return ratio	9	4	5
Market risk-return ratio	185	103	82
Attractiveness of asset	194	107	87
General rate of interest	88	42	46
Costs of new loans	190	95	95
Attractiveness of financed investments	156	79	77
New loans for investments	292	145	147
Creditworthiness of financed investors	159	79	80
Payments for new loans	212	102	110
Risk of debt default	309	156	153
Loans for investments	49	23	26
Asset cash flow	309	156	153
Payments for loans	212	102	110
Liquidity of banks	344	174	170
Euphoria	114	58	56
Short sale	18	9	9
Risk of misbehaviour	108	55	53
Risk of contagion	305	158	147
Creditworthiness of banks	217	114	103
Uncertainty	260	128	132
Interbank lending	260	128	132
Foreign exchange rate	90	44	46
Money supply	215	105	110

Appendix 3_Involved elements of cycles_Element 20

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	102	54	48
Asset supply	123	63	60
Asset price	194	101	93
Expected risk of asset	0	0	0
Expected return of asset	181	94	87
Asset risk-return ratio	6	4	2
Market risk-return ratio	118	62	56
Attractiveness of asset	124	66	58
General rate of interest	48	25	23
Costs of new loans	71	37	34
Attractiveness of financed investments	120	62	58
New loans for investments	153	78	75
Creditworthiness of financed investors	53	27	26
Payments for new loans	94	46	48
Risk of debt default	175	90	85
Loans for investments	35	17	18
Asset cash flow	175	90	85
Payments for loans	94	46	48
Liquidity of banks	114	58	56
Euphoria	194	101	93
Short sale	13	7	6
Risk of misbehaviour	0	0	0
Risk of contagion	161	83	78
Creditworthiness of banks	94	49	45
Uncertainty	131	66	65
Interbank lending	131	66	65
Foreign exchange rate	30	14	16
Money supply	116	58	58

Appendix 3_Involved elements of cycles_Element 21

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	24	12	12
Asset supply	18	9	9
Asset price	26	13	13
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	14	7	7
Attractiveness of asset	14	7	7
General rate of interest	6	3	3
Costs of new loans	6	3	3
Attractiveness of financed investments	0	0	0
New loans for investments	18	9	9
Creditworthiness of financed investors	6	3	3
Payments for new loans	12	6	6
Risk of debt default	18	9	9
Loans for investments	6	3	3
Asset cash flow	18	9	9
Payments for loans	12	6	6
Liquidity of banks	18	9	9
Euphoria	13	7	6
Short sale	26	13	13
Risk of misbehaviour	0	0	0
Risk of contagion	22	11	11
Creditworthiness of banks	0	0	0
Uncertainty	18	9	9
Interbank lending	18	9	9
Foreign exchange rate	0	0	0
Money supply	18	9	9

Appendix 3_Involved elements of cycles_Element 22

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	95	50	45
Asset supply	116	58	58
Asset price	187	96	91
Expected risk of asset	6	2	4
Expected return of asset	181	94	87
Asset risk-return ratio	12	6	6
Market risk-return ratio	111	58	53
Attractiveness of asset	123	64	59
General rate of interest	45	23	22
Costs of new loans	69	36	33
Attractiveness of financed investments	120	62	58
New loans for investments	147	75	72
Creditworthiness of financed investors	51	26	25
Payments for new loans	90	44	46
Risk of debt default	169	87	82
Loans for investments	33	16	17
Asset cash flow	169	87	82
Payments for loans	90	44	46
Liquidity of banks	108	55	53
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	187	96	91
Risk of contagion	154	79	75
Creditworthiness of banks	94	49	45
Uncertainty	125	63	62
Interbank lending	125	63	62
Foreign exchange rate	30	14	16
Money supply	110	55	55

Appendix 3_Involved elements of cycles_Element 23

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	228	119	109
Asset supply	301	151	150
Asset price	430	220	210
Expected risk of asset	4	2	2
Expected return of asset	300	154	146
Asset risk-return ratio	12	6	6
Market risk-return ratio	279	145	134
Attractiveness of asset	291	151	140
General rate of interest	92	48	44
Costs of new loans	234	121	113
Attractiveness of financed investments	258	131	127
New loans for investments	355	181	174
Creditworthiness of financed investors	202	103	99
Payments for new loans	252	127	125
Risk of debt default	403	206	197
Loans for investments	66	32	34
Asset cash flow	403	206	197
Payments for loans	252	127	125
Liquidity of banks	305	158	147
Euphoria	161	83	78
Short sale	22	11	11
Risk of misbehaviour	154	79	75
Risk of contagion	448	229	219
Creditworthiness of banks	250	130	120
Uncertainty	287	144	143
Interbank lending	287	144	143
Foreign exchange rate	78	40	38
Money supply	248	125	123

Appendix 3_Involved elements of cycles_Element 24

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	84	47	37
Asset supply	162	81	81
Asset price	246	128	118
Expected risk of asset	0	0	0
Expected return of asset	188	98	90
Asset risk-return ratio	0	0	0
Market risk-return ratio	162	88	74
Attractiveness of asset	162	88	74
General rate of interest	57	31	26
Costs of new loans	143	76	67
Attractiveness of financed investments	180	92	88
New loans for investments	189	98	91
Creditworthiness of financed investors	119	62	57
Payments for new loans	150	77	73
Risk of debt default	222	116	106
Loans for investments	37	18	19
Asset cash flow	222	116	106
Payments for loans	150	77	73
Liquidity of banks	217	114	103
Euphoria	94	49	45
Short sale	0	0	0
Risk of misbehaviour	94	49	45
Risk of contagion	250	130	120
Creditworthiness of banks	250	130	120
Uncertainty	156	80	76
Interbank lending	156	80	76
Foreign exchange rate	66	34	32
Money supply	123	64	59

Appendix 3_Involved elements of cycles_Element 25

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	196	98	98
Asset supply	220	110	110
Asset price	354	177	177
Expected risk of asset	3	2	1
Expected return of asset	244	122	122
Asset risk-return ratio	9	4	5
Market risk-return ratio	234	121	113
Attractiveness of asset	243	125	118
General rate of interest	130	66	64
Costs of new loans	189	94	95
Attractiveness of financed investments	202	101	101
New loans for investments	306	149	157
Creditworthiness of financed investors	149	72	77
Payments for new loans	214	101	113
Risk of debt default	379	190	189
Loans for investments	60	28	32
Asset cash flow	379	190	189
Payments for loans	214	101	113
Liquidity of banks	260	128	132
Euphoria	131	66	65
Short sale	18	9	9
Risk of misbehaviour	125	63	62
Risk of contagion	287	144	143
Creditworthiness of banks	156	80	76
Uncertainty	379	190	189
Interbank lending	379	190	189
Foreign exchange rate	90	44	46
Money supply	334	167	167

Appendix 3_Involved elements of cycles_Element 26

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	196	98	98
Asset supply	220	110	110
Asset price	354	177	177
Expected risk of asset	3	2	1
Expected return of asset	244	122	122
Asset risk-return ratio	9	4	5
Market risk-return ratio	234	121	113
Attractiveness of asset	243	125	118
General rate of interest	130	66	64
Costs of new loans	189	94	95
Attractiveness of financed investments	202	101	101
New loans for investments	306	149	157
Creditworthiness of financed investors	149	72	77
Payments for new loans	214	101	113
Risk of debt default	379	190	189
Loans for investments	60	28	32
Asset cash flow	379	190	189
Payments for loans	214	101	113
Liquidity of banks	260	128	132
Euphoria	131	66	65
Short sale	18	9	9
Risk of misbehaviour	125	63	62
Risk of contagion	287	144	143
Creditworthiness of banks	156	80	76
Uncertainty	379	190	189
Interbank lending	379	190	189
Foreign exchange rate	90	44	46
Money supply	334	167	167

Appendix 3_Involved elements of cycles_Element 27

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	40	18	22
Asset supply	56	28	28
Asset price	84	40	44
Expected risk of asset	0	0	0
Expected return of asset	60	28	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	50	30	20
Attractiveness of asset	50	30	20
General rate of interest	45	22	23
Costs of new loans	38	18	20
Attractiveness of financed investments	48	22	26
New loans for investments	72	32	40
Creditworthiness of financed investors	38	18	20
Payments for new loans	46	20	26
Risk of debt default	90	44	46
Loans for investments	14	6	8
Asset cash flow	90	44	46
Payments for loans	46	20	26
Liquidity of banks	90	44	46
Euphoria	30	14	16
Short sale	0	0	0
Risk of misbehaviour	30	14	16
Risk of contagion	78	40	38
Creditworthiness of banks	66	34	32
Uncertainty	90	44	46
Interbank lending	90	44	46
Foreign exchange rate	90	44	46
Money supply	90	44	46

Appendix 3_Involved elements of cycles_Element 28

Element	Overall number of cycles	Positive cycles	Negative cycles
Asset demand	176	87	89
Asset supply	192	96	96
Asset price	312	155	157
Expected risk of asset	3	2	1
Expected return of asset	214	106	108
Asset risk-return ratio	9	4	5
Market risk-return ratio	209	111	98
Attractiveness of asset	218	115	103
General rate of interest	130	66	64
Costs of new loans	170	84	86
Attractiveness of financed investments	178	88	90
New loans for investments	270	129	141
Creditworthiness of financed investors	130	62	68
Payments for new loans	191	88	103
Risk of debt default	334	167	167
Loans for investments	53	24	29
Asset cash flow	334	167	167
Payments for loans	191	88	103
Liquidity of banks	215	105	110
Euphoria	116	58	58
Short sale	18	9	9
Risk of misbehaviour	110	55	55
Risk of contagion	248	125	123
Creditworthiness of banks	123	64	59
Uncertainty	334	167	167
Interbank lending	334	167	167
Foreign exchange rate	90	44	46
Money supply	334	167	167

Appendix 4: Paths of the system

This chapter shows all identified paths of the systemic financial crisis model from the elements to Element 3 “Asset price”, Element 19 “Liquidity of banks” and Element 27 “Foreign exchange rate”. The details of this chapter are interpreted in Chapter 5.3. The background of this kind of analysis is described in Chapter 3.4.4.

The tables contain three columns. The first column numbers consecutively the identified paths. The second column contains the chain of elements. The last column shows the direction of paths. The value 1 defines a positive paths which means that the initial impulse is directly transferred. The value -1 defines a negative paths which causes a reversal of the initial impulse.

Appendix 4_Paths of the system_From element 1 to element 3

#	Path	Direction
1	{1, 3}	1
2	{1, 23, 2, 3}	1
3	{1, 23, 7, 8, 2, 3}	-1
4	{1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
5	{1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
6	{1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
7	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
8	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
9	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
10	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
11	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
12	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
1	{1, 23, 19}	1
2	{1, 3, 20, 5, 11, 12, 19}	-1
3	{1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
4	{1, 3, 22, 5, 11, 12, 19}	-1
5	{1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
6	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
7	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
8	{1, 3, 13, 10, 11, 12, 19}	-1
9	{1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
10	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
11	{1, 3, 13, 10, 14, 18, 19}	-1
12	{1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
13	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
14	{1, 3, 20, 5, 11, 12, 14, 18, 19}	1
15	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
16	{1, 3, 22, 5, 11, 12, 14, 18, 19}	1
17	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
18	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
19	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
20	{1, 3, 13, 10, 11, 12, 14, 18, 19}	1
21	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
22	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
23	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
24	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
25	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
26	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
27	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
28	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
29	{1, 3, 20, 5, 17, 15, 23, 19}	1
30	{1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
31	{1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
32	{1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
33	{1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
34	{1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
35	{1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
36	{1, 3, 22, 5, 17, 15, 23, 19}	1
37	{1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
38	{1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
39	{1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
40	{1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
41	{1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
42	{1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
43	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
44	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
45	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
46	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
47	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
48	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
49	{1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
50	{1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
51	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
52	{1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
53	{1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
54	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
55	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
56	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
57	{1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
58	{1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
59	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
60	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
61	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
62	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
63	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
64	{1, 3, 20, 5, 17, 15, 24, 23, 19}	1
65	{1, 3, 22, 5, 17, 15, 24, 23, 19}	1
66	{1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
67	{1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
68	{1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
69	{1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
70	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
71	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
72	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
73	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
74	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
75	{1, 3, 20, 5, 17, 15, 25, 26, 19}	1
76	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
77	{1, 3, 22, 5, 17, 15, 25, 26, 19}	1
78	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
79	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
80	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
81	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
82	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
83	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
84	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
85	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
86	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
87	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
88	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
89	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
90	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
91	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
92	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
93	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
94	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
95	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
96	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
97	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
98	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
99	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
100	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
101	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
102	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
103	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
104	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
105	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
106	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
107	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
108	{1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
109	{1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
110	{1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
111	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
112	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
113	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
114	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
115	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
116	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
117	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
118	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
119	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
120	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
121	{1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
122	{1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
123	{1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
124	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
125	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
126	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
127	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
128	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
129	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
130	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
131	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
132	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
133	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
134	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
135	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
136	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
137	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
138	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
139	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
140	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
141	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
142	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
143	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
144	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
145	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
146	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
147	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
148	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
149	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
150	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
151	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
152	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
153	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
154	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
155	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
156	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
157	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
158	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
159	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
160	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
161	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
162	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
163	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
164	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
165	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
166	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
167	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
168	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
169	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
170	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
171	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
172	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
173	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
174	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
175	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
176	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
177	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
178	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
179	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
180	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
181	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
182	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
183	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
184	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
185	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
186	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
187	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
188	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
189	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
190	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
191	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
192	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
193	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
194	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
195	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
196	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
197	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
198	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
199	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
200	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
201	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
202	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
203	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
204	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 1 to element 19

#	Path	Direction
205	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
206	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
207	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
208	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
209	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
210	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
211	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
212	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
213	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
214	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
215	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
216	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
217	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
218	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
219	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
220	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
221	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
222	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
223	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
224	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
225	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
226	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
227	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
228	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
229	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
230	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
231	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
232	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
233	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
234	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
235	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
236	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
237	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
238	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
239	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
240	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
241	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 1 to element 27

#	Path	Direction
1	{1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
6	{1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
10	{1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
12	{1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
14	{1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
16	{1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
18	{1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
20	{1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
24	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
26	{1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
27	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
30	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 1 to element 27

#	Path	Direction
31	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
34	{1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
35	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
36	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
37	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
40	{1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
41	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
44	{1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
45	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
48	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
49	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
52	{1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
53	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 1 to element 27

#	Path	Direction
62	{1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
63	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
64	{1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 2	-1
65	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 2	-1
67	{1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
68	{1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
69	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
70	{1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
71	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
72	{1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
73	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
74	{1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
75	{1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
76	{1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
77	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
78	{1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 2 to element 3

#	Path	Direction
1	{2, 3}	-1

Appendix 4_Paths of the system_From element 2 to element 19

#	Path	Direction
1	{2, 3, 21, 1, 23, 19}	-1
2	{2, 3, 20, 21, 1, 23, 19}	1
3	{2, 3, 22, 4, 6, 8, 1, 23, 19}	1
4	{2, 3, 20, 5, 6, 8, 1, 23, 19}	-1
5	{2, 3, 22, 5, 6, 8, 1, 23, 19}	-1
6	{2, 3, 20, 5, 11, 12, 19}	1
7	{2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
8	{2, 3, 22, 5, 11, 12, 19}	1
9	{2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
10	{2, 3, 13, 10, 11, 12, 19}	1
11	{2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
12	{2, 3, 13, 10, 14, 18, 19}	1
13	{2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
14	{2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
15	{2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
16	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
17	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
18	{2, 3, 20, 5, 17, 15, 23, 19}	-1
19	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
20	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
21	{2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
22	{2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
23	{2, 3, 22, 5, 17, 15, 23, 19}	-1
24	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
25	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
26	{2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
27	{2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
28	{2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
29	{2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
30	{2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1

Appendix 4_Paths of the system_From element 2 to element 19

#	Path	Direction
31	{2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
32	{2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
33	{2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
34	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
35	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
36	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
37	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
38	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
39	{2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
40	{2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
41	{2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
42	{2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
43	{2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
44	{2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
45	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
46	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
47	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
48	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
49	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
50	{2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
51	{2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
52	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
53	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
54	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
55	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
56	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
57	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
58	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
59	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
60	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
61	{2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1

Appendix 4_Paths of the system_From element 2 to element 19

#	Path	Direction
62	{2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
63	{2, 3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
64	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
65	{2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
66	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
67	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
68	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
69	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
70	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
71	{2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
72	{2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
73	{2, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
74	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
75	{2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
76	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
77	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
78	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
79	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
80	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
81	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
82	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
83	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
84	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
85	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
86	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
87	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
88	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
89	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
90	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
91	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
92	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 2 to element 19

#	Path	Direction
93	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
94	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
95	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
96	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
97	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
98	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
99	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
100	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
101	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
102	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
103	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
104	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
105	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
106	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
107	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
108	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
109	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
110	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
111	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
112	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
113	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
114	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
115	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
116	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
117	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
118	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
119	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
120	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
121	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
122	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
123	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 2 to element 19

#	Path	Direction
124	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
125	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
126	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
127	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
128	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
129	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
130	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
131	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
132	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
133	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
134	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
135	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
136	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 2 to element 27

#	Path	Direction
1	{2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
2	{2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
3	{2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
4	{2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
6	{2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
7	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
8	{2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
9	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
10	{2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
11	{2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
12	{2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
13	{2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
14	{2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
16	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
18	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
20	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
22	{2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
23	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
24	{2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
26	{2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
27	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
28	{2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
29	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
30	{2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 2 to element 27

#	Path	Direction
31	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
34	{2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
35	{2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
36	{2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
37	{2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
38	{2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
39	{2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
40	{2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
41	{2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
44	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
45	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
48	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
49	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
51	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 3 to element 19

#	Path	Direction
1	{3, 21, 1, 23, 19}	1
2	{3, 20, 21, 1, 23, 19}	-1
3	{3, 22, 4, 6, 8, 1, 23, 19}	-1
4	{3, 20, 5, 6, 8, 1, 23, 19}	1
5	{3, 22, 5, 6, 8, 1, 23, 19}	1
6	{3, 20, 5, 11, 12, 19}	-1
7	{3, 20, 5, 11, 12, 1, 23, 19}	1
8	{3, 22, 5, 11, 12, 19}	-1
9	{3, 22, 5, 11, 12, 1, 23, 19}	1
10	{3, 13, 10, 11, 12, 19}	-1
11	{3, 13, 10, 11, 12, 1, 23, 19}	1
12	{3, 13, 10, 14, 18, 19}	-1
13	{3, 20, 5, 11, 12, 14, 18, 19}	1
14	{3, 22, 5, 11, 12, 14, 18, 19}	1
15	{3, 13, 10, 11, 12, 14, 18, 19}	1
16	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
17	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
18	{3, 20, 5, 17, 15, 23, 19}	1
19	{3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
20	{3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
21	{3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
22	{3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
23	{3, 22, 5, 17, 15, 23, 19}	1
24	{3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
25	{3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
26	{3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
27	{3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
28	{3, 20, 5, 11, 12, 17, 15, 23, 19}	1
29	{3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
30	{3, 22, 5, 11, 12, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 3 to element 19

#	Path	Direction
31	{3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
32	{3, 13, 10, 11, 12, 17, 15, 23, 19}	1
33	{3, 13, 10, 14, 18, 17, 15, 23, 19}	1
34	{3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
35	{3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
36	{3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
37	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
38	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
39	{3, 20, 5, 17, 15, 24, 23, 19}	1
40	{3, 22, 5, 17, 15, 24, 23, 19}	1
41	{3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
42	{3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
43	{3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
44	{3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
45	{3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
46	{3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
47	{3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
48	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
49	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
50	{3, 20, 5, 17, 15, 25, 26, 19}	1
51	{3, 22, 5, 17, 15, 25, 26, 19}	1
52	{3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
53	{3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
54	{3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
55	{3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
56	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
57	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
58	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
59	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
60	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
61	{3, 20, 5, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 3 to element 19

#	Path	Direction
62	{3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
63	{3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
64	{3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
65	{3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
66	{3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
67	{3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
68	{3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
69	{3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
70	{3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
71	{3, 22, 5, 17, 15, 25, 26, 28, 19}	1
72	{3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
73	{3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
74	{3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
75	{3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
76	{3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
77	{3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
78	{3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
79	{3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
80	{3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
81	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
82	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
83	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
84	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
85	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
86	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
87	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
88	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
89	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
90	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
91	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
92	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 3 to element 19

#	Path	Direction
93	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
94	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
95	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
96	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
97	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
98	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
99	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
100	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
101	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
102	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
103	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
104	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
105	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
106	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
107	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
108	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
109	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
110	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
111	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
112	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
113	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
114	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
115	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
116	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
117	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
118	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
119	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
120	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
121	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
122	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
123	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 3 to element 19

#	Path	Direction
124	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
125	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
126	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
127	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
128	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
129	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
130	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
131	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
132	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
133	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
134	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
135	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
136	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 3 to element 27

#	Path	Direction
1	{3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
4	{3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
6	{3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
7	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
8	{3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
9	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
10	{3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
11	{3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
12	{3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
13	{3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
14	{3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
16	{3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
18	{3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
20	{3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
22	{3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
23	{3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
24	{3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
26	{3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
27	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
28	{3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
29	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
30	{3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 3 to element 27

#	Path	Direction
31	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
32	{3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
33	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
34	{3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
35	{3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
36	{3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
37	{3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
40	{3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
41	{3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
44	{3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
45	{3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
48	{3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
49	{3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
52	{3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
53	{3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 4 to element 3

#	Path	Direction
1	{4, 6, 8, 1, 3}	-1
2	{4, 6, 8, 2, 3}	-1
3	{4, 6, 8, 1, 23, 2, 3}	-1
4	{4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
5	{4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
6	{4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
1	{4, 6, 8, 1, 23, 19}	-1
2	{4, 6, 8, 2, 3, 21, 1, 23, 19}	-1
3	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19}	1
4	{4, 6, 8, 1, 3, 20, 5, 11, 12, 19}	1
5	{4, 6, 8, 2, 3, 20, 5, 11, 12, 19}	1
6	{4, 6, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
7	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
8	{4, 6, 8, 1, 3, 22, 5, 11, 12, 19}	1
9	{4, 6, 8, 2, 3, 22, 5, 11, 12, 19}	1
10	{4, 6, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
11	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
12	{4, 6, 8, 1, 3, 13, 10, 11, 12, 19}	1
13	{4, 6, 8, 2, 3, 13, 10, 11, 12, 19}	1
14	{4, 6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
15	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
16	{4, 6, 8, 1, 3, 13, 10, 14, 18, 19}	1
17	{4, 6, 8, 2, 3, 13, 10, 14, 18, 19}	1
18	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
19	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
20	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
21	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
22	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
23	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
24	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
25	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
26	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
27	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
28	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
29	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
30	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
31	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
32	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
33	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
34	{4, 6, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
35	{4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
36	{4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
37	{4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
38	{4, 6, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
39	{4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
40	{4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
41	{4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
42	{4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
43	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
44	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
45	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
46	{4, 6, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
47	{4, 6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
48	{4, 6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
49	{4, 6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
50	{4, 6, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
51	{4, 6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
52	{4, 6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
53	{4, 6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
54	{4, 6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
55	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
56	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
57	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
58	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
59	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
60	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
61	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
62	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
63	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
64	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
65	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
66	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
67	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
68	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
69	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
70	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
71	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
72	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
73	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
74	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
75	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
76	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
77	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
78	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
79	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
80	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
81	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
82	{4, 6, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
83	{4, 6, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
84	{4, 6, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
85	{4, 6, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
86	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
87	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
88	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
89	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
90	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
91	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
92	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
93	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
94	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
95	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
96	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
97	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
98	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
99	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
100	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
101	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
102	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
103	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
104	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
105	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
106	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
107	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
108	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
109	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
110	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
111	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
112	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
113	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
114	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
115	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
116	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
117	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
118	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
119	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
120	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
121	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
122	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
123	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
124	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
125	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
126	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
127	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
128	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
129	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
130	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
131	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
132	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
133	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
134	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
135	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
136	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
137	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
138	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
139	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
140	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
141	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
142	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
143	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
144	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
145	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
146	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
147	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
148	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
149	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
150	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
151	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
152	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
153	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
154	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
155	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
156	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
157	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
158	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
159	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
160	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
161	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
162	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
163	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
164	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
165	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
166	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
167	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
168	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
169	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
170	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
171	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
172	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
173	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
174	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
175	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
176	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
177	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
178	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
179	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
180	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
181	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
182	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
183	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
184	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
185	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
186	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
187	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
188	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
189	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
190	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
191	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
192	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
193	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
194	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
195	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
196	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
197	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
198	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
199	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
200	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
201	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
202	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
203	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
204	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
205	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
206	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
207	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
208	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
209	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
210	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
211	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
212	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
213	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
214	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
215	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
216	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
217	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
218	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
219	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
220	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
221	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
222	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
223	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
224	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
225	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
226	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
227	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
228	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
229	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
230	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
231	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
232	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
233	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
234	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
235	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
236	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
237	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
238	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
239	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
240	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
241	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
242	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
243	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
244	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
245	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
246	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
247	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
248	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
249	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
250	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
251	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
252	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
253	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
254	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
255	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
256	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
257	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
258	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
259	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
260	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
261	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
262	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
263	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
264	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
265	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
266	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
267	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
268	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
269	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
270	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
271	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
272	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
273	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
274	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
275	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
276	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
277	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
278	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 4 to element 19

#	Path	Direction
279	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
280	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
281	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
282	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
283	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 4 to element 27

#	Path	Direction
1	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
2	{4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
3	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{4, 6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{4, 6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
12	{4, 6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
16	{4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
18	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
20	{4, 6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{4, 6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
24	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
26	{4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
27	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
28	{4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
29	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
30	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 4 to element 27

#	Path	Direction
31	{4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
32	{4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
33	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
34	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
35	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
36	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
37	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{4, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
40	{4, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
41	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{4, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
44	{4, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
48	{4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
49	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
51	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
56	{4, 6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
57	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{4, 6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
59	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
60	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
61	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 4 to element 27

#	Path	Direction
62	{4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
64	{4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
65	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
67	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
72	{4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
73	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
74	{4, 6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
75	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{4, 6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
78	{4, 6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
79	{4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
80	{4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
81	{4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
82	{4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
83	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
84	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
85	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
86	{4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
87	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
88	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
89	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
90	{4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
1	{5, 6, 8, 1, 3}	1
2	{5, 6, 8, 2, 3}	1
3	{5, 6, 8, 1, 23, 2, 3}	1
4	{5, 11, 12, 1, 3}	1
5	{5, 11, 12, 1, 23, 2, 3}	1
6	{5, 11, 12, 1, 23, 7, 8, 2, 3}	-1
7	{5, 17, 15, 23, 2, 3}	1
8	{5, 17, 15, 23, 7, 8, 1, 3}	-1
9	{5, 17, 15, 23, 7, 8, 2, 3}	-1
10	{5, 17, 15, 13, 10, 11, 12, 1, 3}	1
11	{5, 17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	1
12	{5, 17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
13	{5, 17, 15, 23, 19, 12, 1, 3}	1
14	{5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 3}	-1
15	{5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
16	{5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
17	{5, 11, 12, 17, 15, 23, 2, 3}	1
18	{5, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
19	{5, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
20	{5, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
21	{5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
22	{5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
23	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
24	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
25	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
26	{5, 11, 12, 19, 24, 23, 2, 3}	-1
27	{5, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
28	{5, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
29	{5, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
30	{5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
31	{5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
32	{5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
33	{5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
34	{5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
35	{5, 17, 15, 24, 23, 2, 3}	1
36	{5, 17, 15, 24, 23, 7, 8, 1, 3}	-1
37	{5, 17, 15, 24, 23, 7, 8, 2, 3}	-1
38	{5, 17, 15, 24, 23, 19, 12, 1, 3}	1
39	{5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
40	{5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
41	{5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
42	{5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
43	{5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
44	{5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
45	{5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
46	{5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
47	{5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
48	{5, 11, 12, 17, 15, 24, 23, 2, 3}	1
49	{5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
50	{5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
51	{5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
52	{5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
53	{5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
54	{5, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
55	{5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
56	{5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
57	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
58	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
59	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
60	{5, 17, 15, 25, 26, 19, 12, 1, 3}	1
61	{5, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
62	{5, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
63	{5, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
64	{5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
65	{5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
66	{5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
67	{5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
68	{5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
69	{5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
70	{5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
71	{5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
72	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
73	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
74	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
75	{5, 17, 15, 25, 26, 28, 3}	1
76	{5, 17, 15, 25, 26, 28, 23, 2, 3}	-1
77	{5, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
78	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
79	{5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
80	{5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
81	{5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
82	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
83	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
84	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
85	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	1
86	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	1
87	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
88	{5, 17, 15, 25, 26, 28, 19, 12, 1, 3}	1
89	{5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	1
90	{5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
91	{5, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	-1
92	{5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	-1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
93	{5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
94	{5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
95	{5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	-1
96	{5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
97	{5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
98	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
99	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
100	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
101	{5, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
102	{5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
103	{5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
104	{5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
105	{5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
106	{5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
107	{5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
108	{5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
109	{5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
110	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
111	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
112	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
113	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
114	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
115	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
116	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
117	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
118	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
119	{5, 11, 12, 17, 15, 25, 26, 28, 3}	1
120	{5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
121	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
122	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
123	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
124	{5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
125	{5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
126	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
127	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
128	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
129	{5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
130	{5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
131	{5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
132	{5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
133	{5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
134	{5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
135	{5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
136	{5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
137	{5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
138	{5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
139	{5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
140	{5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
141	{5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
142	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
143	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
144	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
145	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
146	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
147	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
148	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
149	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
150	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
151	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
152	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
153	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
154	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 5 to element 3

#	Path	Direction
155	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
156	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
157	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
158	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
159	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
160	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
161	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
162	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
163	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
164	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
165	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
166	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
167	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
168	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
169	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
170	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
171	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
172	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
173	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
174	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
175	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
176	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
177	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
178	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
179	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
180	{5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
181	{5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
1	{5, 6, 8, 1, 23, 19}	1
2	{5, 6, 8, 2, 3, 21, 1, 23, 19}	1
3	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19}	-1
4	{5, 11, 12, 19}	-1
5	{5, 11, 12, 1, 23, 19}	1
6	{5, 6, 8, 1, 3, 13, 10, 11, 12, 19}	-1
7	{5, 6, 8, 2, 3, 13, 10, 11, 12, 19}	-1
8	{5, 6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
9	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
10	{5, 6, 8, 1, 3, 13, 10, 14, 18, 19}	-1
11	{5, 6, 8, 2, 3, 13, 10, 14, 18, 19}	-1
12	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
13	{5, 11, 12, 14, 18, 19}	1
14	{5, 11, 12, 1, 3, 13, 10, 14, 18, 19}	-1
15	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
16	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
17	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
18	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
19	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
20	{5, 11, 12, 16, 13, 10, 14, 18, 19}	1
21	{5, 17, 15, 23, 19}	1
22	{5, 17, 15, 13, 10, 11, 12, 19}	-1
23	{5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
24	{5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	-1
25	{5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
26	{5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
27	{5, 17, 15, 13, 10, 14, 18, 19}	-1
28	{5, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
29	{5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
30	{5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
31	{5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
32	{5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
33	{5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
34	{5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
35	{5, 11, 12, 17, 15, 23, 19}	1
36	{5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
37	{5, 11, 12, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
38	{5, 11, 12, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
39	{5, 11, 12, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
40	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
41	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
42	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
43	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
44	{5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
45	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
46	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
47	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
48	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
49	{5, 17, 15, 24, 23, 19}	1
50	{5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	-1
51	{5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
52	{5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
53	{5, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
54	{5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
55	{5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
56	{5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
57	{5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
58	{5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
59	{5, 11, 12, 17, 15, 24, 23, 19}	1
60	{5, 11, 12, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
61	{5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
62	{5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
63	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
64	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
65	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
66	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
67	{5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
68	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
69	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
70	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
71	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
72	{5, 17, 15, 25, 26, 19}	1
73	{5, 11, 12, 17, 15, 25, 26, 19}	1
74	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
75	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
76	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
77	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
78	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
79	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
80	{5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
81	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
82	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
83	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
84	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
85	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
86	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
87	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
88	{5, 17, 15, 25, 26, 28, 19}	1
89	{5, 17, 15, 25, 26, 28, 23, 19}	-1
90	{5, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
91	{5, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
92	{5, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
93	{5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
94	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
95	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
96	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
97	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
98	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
99	{5, 17, 15, 25, 26, 28, 27, 19}	-1
100	{5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
101	{5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	-1
102	{5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	1
103	{5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	1
104	{5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
105	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
106	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
107	{5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
108	{5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
109	{5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
110	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
111	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
112	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
113	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
114	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
115	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
116	{5, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
117	{5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
118	{5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
119	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
120	{5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
121	{5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
122	{5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
123	{5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
124	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
125	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
126	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
127	{5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	1
128	{5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
129	{5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
130	{5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
131	{5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
132	{5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
133	{5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
134	{5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
135	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
136	{5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
137	{5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
138	{5, 11, 12, 17, 15, 25, 26, 28, 19}	1
139	{5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
140	{5, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
141	{5, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
142	{5, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
143	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
144	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
145	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
146	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
147	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
148	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
149	{5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
150	{5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
151	{5, 11, 12, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
152	{5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
153	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
154	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
155	{5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
156	{5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
157	{5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
158	{5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
159	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
160	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
161	{5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
162	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
163	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
164	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
165	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
166	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
167	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
168	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
169	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
170	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
171	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
172	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
173	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
174	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
175	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
176	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
177	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
178	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
179	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
180	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
181	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
182	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
183	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
184	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
185	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
186	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
187	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
188	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
189	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
190	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
191	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
192	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
193	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
194	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
195	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
196	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
197	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
198	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
199	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
200	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
201	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
202	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
203	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
204	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
205	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
206	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
207	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
208	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
209	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
210	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
211	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
212	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
213	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
214	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
215	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
216	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 5 to element 19

#	Path	Direction
217	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
218	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
219	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
220	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
221	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
222	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
223	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
224	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
225	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
226	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
227	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
228	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
229	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
230	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 5 to element 27

#	Path	Direction
1	{5, 17, 15, 25, 26, 28, 27}	-1
2	{5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
4	{5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
5	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
6	{5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
7	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
8	{5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
9	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
10	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
11	{5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
12	{5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
13	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
14	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
16	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
18	{5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
19	{5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
20	{5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
22	{5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
23	{5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
24	{5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
26	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
27	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
28	{5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
29	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
30	{5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 5 to element 27

#	Path	Direction
31	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
34	{5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
35	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
36	{5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
37	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
40	{5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
41	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
44	{5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
45	{5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
48	{5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
49	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
52	{5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
53	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
56	{5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
57	{5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
60	{5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
61	{5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 5 to element 27

#	Path	Direction
62	{5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 6 to element 3

#	Path	Direction
1	{6, 8, 1, 3}	1
2	{6, 8, 2, 3}	1
3	{6, 8, 1, 23, 2, 3}	1
4	{6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
5	{6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
6	{6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
1	{6, 8, 1, 23, 19}	1
2	{6, 8, 2, 3, 21, 1, 23, 19}	1
3	{6, 8, 2, 3, 20, 21, 1, 23, 19}	-1
4	{6, 8, 1, 3, 20, 5, 11, 12, 19}	-1
5	{6, 8, 2, 3, 20, 5, 11, 12, 19}	-1
6	{6, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
7	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
8	{6, 8, 1, 3, 22, 5, 11, 12, 19}	-1
9	{6, 8, 2, 3, 22, 5, 11, 12, 19}	-1
10	{6, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
11	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
12	{6, 8, 1, 3, 13, 10, 11, 12, 19}	-1
13	{6, 8, 2, 3, 13, 10, 11, 12, 19}	-1
14	{6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
15	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
16	{6, 8, 1, 3, 13, 10, 14, 18, 19}	-1
17	{6, 8, 2, 3, 13, 10, 14, 18, 19}	-1
18	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
19	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
20	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
21	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
22	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
23	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
24	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
25	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
26	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
27	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
28	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
29	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
30	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
31	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
32	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
33	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
34	{6, 8, 1, 3, 20, 5, 17, 15, 23, 19}	1
35	{6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
36	{6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
37	{6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
38	{6, 8, 2, 3, 20, 5, 17, 15, 23, 19}	1
39	{6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
40	{6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
41	{6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
42	{6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
43	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
44	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
45	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
46	{6, 8, 1, 3, 22, 5, 17, 15, 23, 19}	1
47	{6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
48	{6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
49	{6, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
50	{6, 8, 2, 3, 22, 5, 17, 15, 23, 19}	1
51	{6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
52	{6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
53	{6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
54	{6, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
55	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
56	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
57	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
58	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
59	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
60	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
61	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
62	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
63	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
64	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
65	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
66	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
67	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
68	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
69	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
70	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
71	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
72	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
73	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
74	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
75	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
76	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
77	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
78	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
79	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
80	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
81	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
82	{6, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
83	{6, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	1
84	{6, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
85	{6, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
86	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
87	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
88	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
89	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
90	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
91	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
92	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
93	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
94	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
95	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
96	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
97	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
98	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
99	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
100	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
101	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
102	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
103	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
104	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
105	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
106	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
107	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
108	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
109	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
110	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
111	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
112	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
113	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
114	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
115	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
116	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
117	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
118	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
119	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
120	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
121	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
122	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
123	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
124	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
125	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
126	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
127	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
128	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
129	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
130	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
131	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
132	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
133	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
134	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
135	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
136	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
137	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
138	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
139	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
140	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
141	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
142	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
143	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
144	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
145	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
146	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
147	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
148	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
149	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
150	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
151	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
152	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
153	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
154	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
155	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
156	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
157	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
158	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
159	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
160	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
161	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
162	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
163	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
164	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
165	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
166	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
167	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
168	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
169	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
170	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
171	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
172	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
173	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
174	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
175	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
176	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
177	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
178	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
179	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
180	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
181	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
182	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
183	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
184	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
185	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
186	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
187	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
188	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
189	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
190	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
191	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
192	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
193	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
194	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
195	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
196	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
197	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
198	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
199	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
200	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
201	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
202	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
203	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
204	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
205	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
206	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
207	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
208	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
209	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
210	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
211	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
212	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
213	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
214	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
215	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
216	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
217	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
218	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
219	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
220	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
221	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
222	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
223	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
224	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
225	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
226	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
227	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
228	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
229	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
230	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
231	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
232	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
233	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
234	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
235	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
236	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
237	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
238	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
239	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
240	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
241	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
242	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
243	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
244	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
245	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
246	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
247	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
248	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
249	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
250	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
251	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
252	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
253	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
254	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
255	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
256	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
257	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
258	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
259	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
260	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
261	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
262	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
263	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
264	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
265	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
266	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
267	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
268	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
269	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
270	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
271	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
272	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
273	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
274	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
275	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
276	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
277	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
278	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 6 to element 19

#	Path	Direction
279	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
280	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
281	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
282	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
283	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 6 to element 27

#	Path	Direction
1	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{6, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{6, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{6, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
14	{6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
16	{6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
18	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
20	{6, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
22	{6, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
23	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
26	{6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
27	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
30	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 6 to element 27

#	Path	Direction
31	{6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
32	{6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
33	{6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
34	{6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
35	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
36	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
37	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
38	{6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
39	{6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
40	{6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
41	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
44	{6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
45	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
48	{6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
52	{6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
53	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
55	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{6, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{6, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 6 to element 27

#	Path	Direction
62	{6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
63	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
64	{6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
65	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
66	{6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
67	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
68	{6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
69	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
70	{6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
71	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
72	{6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
73	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{6, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
76	{6, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
77	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
78	{6, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
79	{6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
80	{6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
81	{6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
82	{6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
83	{6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
84	{6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
85	{6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
86	{6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
87	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
88	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
89	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
90	{6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 7 to element 3

#	Path	Direction
1	{7, 8, 1, 3}	-1
2	{7, 8, 2, 3}	-1
3	{7, 8, 1, 23, 2, 3}	-1
4	{7, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
5	{7, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
6	{7, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
1	{7, 8, 1, 23, 19}	-1
2	{7, 8, 2, 3, 21, 1, 23, 19}	-1
3	{7, 8, 2, 3, 20, 21, 1, 23, 19}	1
4	{7, 8, 1, 3, 20, 5, 11, 12, 19}	1
5	{7, 8, 2, 3, 20, 5, 11, 12, 19}	1
6	{7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
7	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
8	{7, 8, 1, 3, 22, 5, 11, 12, 19}	1
9	{7, 8, 2, 3, 22, 5, 11, 12, 19}	1
10	{7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
11	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
12	{7, 8, 1, 3, 13, 10, 11, 12, 19}	1
13	{7, 8, 2, 3, 13, 10, 11, 12, 19}	1
14	{7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
15	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
16	{7, 8, 1, 3, 13, 10, 14, 18, 19}	1
17	{7, 8, 2, 3, 13, 10, 14, 18, 19}	1
18	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
19	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
20	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
21	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
22	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
23	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
24	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
25	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
26	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
27	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
28	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
29	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
30	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
31	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
32	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
33	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
34	{7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
35	{7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
36	{7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
37	{7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
38	{7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
39	{7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
40	{7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
41	{7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
42	{7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
43	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
44	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
45	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
46	{7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
47	{7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
48	{7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
49	{7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
50	{7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
51	{7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
52	{7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
53	{7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
54	{7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
55	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
56	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
57	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
58	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
59	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
60	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
61	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
62	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
63	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
64	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
65	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
66	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
67	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
68	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
69	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
70	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
71	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
72	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
73	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
74	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
75	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
76	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
77	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
78	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
79	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
80	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
81	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
82	{7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
83	{7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
84	{7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
85	{7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
86	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
87	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
88	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
89	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
90	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
91	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
92	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
93	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
94	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
95	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
96	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
97	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
98	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
99	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
100	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
101	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
102	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
103	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
104	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
105	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
106	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
107	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
108	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
109	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
110	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
111	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
112	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
113	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
114	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
115	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
116	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
117	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
118	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
119	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
120	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
121	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
122	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
123	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
124	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
125	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
126	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
127	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
128	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
129	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
130	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
131	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
132	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
133	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
134	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
135	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
136	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
137	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
138	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
139	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
140	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
141	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
142	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
143	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
144	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
145	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
146	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
147	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
148	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
149	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
150	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
151	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
152	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
153	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
154	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
155	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
156	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
157	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
158	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
159	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
160	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
161	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
162	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
163	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
164	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
165	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
166	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
167	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
168	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
169	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
170	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
171	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
172	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
173	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
174	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
175	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
176	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
177	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
178	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
179	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
180	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
181	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
182	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
183	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
184	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
185	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
186	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
187	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
188	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
189	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
190	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
191	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
192	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
193	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
194	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
195	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
196	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
197	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
198	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
199	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
200	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
201	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
202	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
203	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
204	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
205	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
206	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
207	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
208	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
209	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
210	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
211	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
212	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
213	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
214	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
215	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
216	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
217	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
218	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
219	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
220	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
221	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
222	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
223	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
224	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
225	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
226	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
227	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
228	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
229	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
230	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
231	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
232	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
233	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
234	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
235	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
236	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
237	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
238	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
239	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
240	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
241	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
242	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
243	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
244	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
245	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
246	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
247	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
248	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
249	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
250	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
251	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
252	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
253	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
254	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
255	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
256	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
257	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
258	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
259	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
260	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
261	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
262	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
263	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
264	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
265	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
266	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
267	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
268	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
269	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
270	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
271	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
272	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
273	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
274	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
275	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
276	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
277	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
278	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 7 to element 19

#	Path	Direction
279	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
280	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
281	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
282	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
283	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 7 to element 27

#	Path	Direction
1	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
2	{7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
3	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
12	{7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
16	{7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
18	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
20	{7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
24	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
26	{7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
27	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
28	{7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
29	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
30	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 7 to element 27

#	Path	Direction
31	{7, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
32	{7, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
33	{7, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
34	{7, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
35	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
36	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
37	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
40	{7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
41	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
44	{7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
48	{7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
49	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
51	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
56	{7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
57	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
59	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
60	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
61	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 7 to element 27

#	Path	Direction
62	{7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
64	{7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
65	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
67	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
72	{7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
73	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
74	{7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
75	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
78	{7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
79	{7, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
80	{7, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
81	{7, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
82	{7, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
83	{7, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
84	{7, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
85	{7, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
86	{7, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
87	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
88	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
89	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
90	{7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 8 to element 3

#	Path	Direction
1	{8, 1, 3}	1
2	{8, 2, 3}	1
3	{8, 1, 23, 2, 3}	1
4	{8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
5	{8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
6	{8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
1	{8, 1, 23, 19}	1
2	{8, 2, 3, 21, 1, 23, 19}	1
3	{8, 2, 3, 20, 21, 1, 23, 19}	-1
4	{8, 1, 3, 20, 5, 11, 12, 19}	-1
5	{8, 2, 3, 20, 5, 11, 12, 19}	-1
6	{8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
7	{8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
8	{8, 1, 3, 22, 5, 11, 12, 19}	-1
9	{8, 2, 3, 22, 5, 11, 12, 19}	-1
10	{8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
11	{8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
12	{8, 1, 3, 13, 10, 11, 12, 19}	-1
13	{8, 2, 3, 13, 10, 11, 12, 19}	-1
14	{8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
15	{8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
16	{8, 1, 3, 13, 10, 14, 18, 19}	-1
17	{8, 2, 3, 13, 10, 14, 18, 19}	-1
18	{8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
19	{8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
20	{8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
21	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
22	{8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
23	{8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
24	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
25	{8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
26	{8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
27	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
28	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
29	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
30	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
31	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
32	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
33	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
34	{8, 1, 3, 20, 5, 17, 15, 23, 19}	1
35	{8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
36	{8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
37	{8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
38	{8, 2, 3, 20, 5, 17, 15, 23, 19}	1
39	{8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
40	{8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
41	{8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
42	{8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
43	{8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
44	{8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
45	{8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
46	{8, 1, 3, 22, 5, 17, 15, 23, 19}	1
47	{8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
48	{8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
49	{8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
50	{8, 2, 3, 22, 5, 17, 15, 23, 19}	1
51	{8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
52	{8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
53	{8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
54	{8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
55	{8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
56	{8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
57	{8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
58	{8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
59	{8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
60	{8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
61	{8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
62	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
63	{8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
64	{8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
65	{8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
66	{8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
67	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
68	{8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
69	{8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
70	{8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
71	{8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
72	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
73	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
74	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
75	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
76	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
77	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
78	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
79	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
80	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
81	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
82	{8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
83	{8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	1
84	{8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
85	{8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
86	{8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
87	{8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
88	{8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
89	{8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
90	{8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
91	{8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
92	{8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
93	{8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
94	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
95	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
96	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
97	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
98	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
99	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
100	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
101	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
102	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
103	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
104	{8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
105	{8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
106	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
107	{8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
108	{8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
109	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
110	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
111	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
112	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
113	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
114	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
115	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
116	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
117	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
118	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
119	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
120	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
121	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
122	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
123	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
124	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
125	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
126	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
127	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
128	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
129	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
130	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
131	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
132	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
133	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
134	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
135	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
136	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
137	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
138	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
139	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
140	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
141	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
142	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
143	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
144	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
145	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
146	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
147	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
148	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
149	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
150	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
151	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
152	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
153	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
154	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
155	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
156	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
157	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
158	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
159	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
160	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
161	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
162	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
163	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
164	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
165	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
166	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
167	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
168	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
169	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
170	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
171	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
172	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
173	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
174	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
175	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
176	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
177	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
178	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
179	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
180	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
181	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
182	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
183	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
184	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
185	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
186	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
187	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
188	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
189	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
190	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
191	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
192	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
193	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
194	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
195	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
196	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
197	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
198	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
199	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
200	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
201	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
202	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
203	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
204	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
205	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
206	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
207	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
208	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
209	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
210	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
211	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
212	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
213	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
214	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
215	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
216	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
217	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
218	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
219	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
220	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
221	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
222	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
223	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
224	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
225	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
226	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
227	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
228	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
229	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
230	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
231	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
232	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
233	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
234	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
235	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
236	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
237	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
238	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
239	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
240	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
241	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
242	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
243	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
244	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
245	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
246	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
247	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
248	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
249	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
250	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
251	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
252	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
253	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
254	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
255	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
256	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
257	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
258	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
259	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
260	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
261	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
262	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
263	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
264	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
265	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
266	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
267	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
268	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
269	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
270	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
271	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
272	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
273	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
274	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
275	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
276	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
277	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
278	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 8 to element 19

#	Path	Direction
279	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
280	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
281	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
282	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
283	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 8 to element 27

#	Path	Direction
1	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
14	{8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
16	{8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
18	{8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
20	{8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
22	{8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
23	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
26	{8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
27	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
30	{8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 8 to element 27

#	Path	Direction
31	{8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
32	{8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
33	{8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
34	{8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
35	{8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
36	{8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
37	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
38	{8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
39	{8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
40	{8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
41	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
44	{8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
45	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
48	{8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
52	{8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
53	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
55	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 8 to element 27

#	Path	Direction
62	{8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
63	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
64	{8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
65	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
66	{8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
67	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
68	{8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
69	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
70	{8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
71	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
72	{8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
73	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
76	{8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
77	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
78	{8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
79	{8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
80	{8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
81	{8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
82	{8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
83	{8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
84	{8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
85	{8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
86	{8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
87	{8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
88	{8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
89	{8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
90	{8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
1	{9, 7, 8, 1, 3}	-1
2	{9, 7, 8, 2, 3}	-1
3	{9, 7, 8, 1, 23, 2, 3}	-1
4	{9, 10, 11, 12, 1, 3}	-1
5	{9, 10, 11, 12, 1, 23, 2, 3}	-1
6	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
7	{9, 27, 19, 12, 1, 3}	1
8	{9, 27, 19, 12, 1, 23, 2, 3}	1
9	{9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
10	{9, 10, 14, 18, 19, 12, 1, 3}	1
11	{9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	1
12	{9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
13	{9, 10, 11, 12, 17, 15, 23, 2, 3}	-1
14	{9, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	1
15	{9, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	1
16	{9, 27, 19, 12, 17, 15, 23, 2, 3}	1
17	{9, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
18	{9, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
19	{9, 10, 14, 18, 17, 15, 23, 2, 3}	-1
20	{9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
21	{9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
22	{9, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	-1
23	{9, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	1
24	{9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
25	{9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
26	{9, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	1
27	{9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
28	{9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
29	{9, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
30	{9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
31	{9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
32	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
33	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
34	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
35	{9, 27, 19, 24, 23, 2, 3}	1
36	{9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
37	{9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
38	{9, 10, 11, 12, 19, 24, 23, 2, 3}	1
39	{9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
40	{9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
41	{9, 10, 14, 18, 19, 24, 23, 2, 3}	1
42	{9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
43	{9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
44	{9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
45	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
46	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
47	{9, 10, 11, 12, 17, 15, 24, 23, 2, 3}	-1
48	{9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
49	{9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
50	{9, 27, 19, 12, 17, 15, 24, 23, 2, 3}	1
51	{9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
52	{9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
53	{9, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
54	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
55	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
56	{9, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
57	{9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	1
58	{9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
59	{9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
60	{9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
61	{9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
62	{9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
63	{9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
64	{9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
65	{9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
66	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
67	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
68	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
69	{9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
70	{9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
71	{9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
72	{9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	-1
73	{9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
74	{9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
75	{9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
76	{9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
77	{9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
78	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
79	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
80	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
81	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3}	-1
82	{9, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	1
83	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
84	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
85	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
86	{9, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
87	{9, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
88	{9, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
89	{9, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
90	{9, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
91	{9, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
92	{9, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
93	{9, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
94	{9, 7, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
95	{9, 27, 19, 12, 17, 15, 25, 26, 28, 3}	1
96	{9, 27, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
97	{9, 27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
98	{9, 27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
99	{9, 27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
100	{9, 27, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
101	{9, 27, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
102	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
103	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
104	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
105	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
106	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
107	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
108	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
109	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	-1
110	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
111	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
112	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	1
113	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	1
114	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
115	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
116	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
117	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
118	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
119	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
120	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
121	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
122	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	1
123	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
124	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
125	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
126	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
127	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
128	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
129	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
130	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	-1
131	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
132	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
133	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
134	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
135	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
136	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
137	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
138	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
139	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
140	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
141	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
142	{9, 7, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
143	{9, 7, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1
144	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
145	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
146	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
147	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
148	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
149	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
150	{9, 27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
151	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
152	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
153	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
154	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 9 to element 3

#	Path	Direction
155	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
156	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
157	{9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
1	{9, 7, 8, 1, 23, 19}	-1
2	{9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
3	{9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
4	{9, 27, 19}	1
5	{9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
6	{9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
7	{9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
8	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
9	{9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
10	{9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
11	{9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
12	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
13	{9, 10, 11, 12, 19}	1
14	{9, 10, 11, 12, 1, 23, 19}	-1
15	{9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
16	{9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
17	{9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
18	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
19	{9, 10, 14, 18, 19}	1
20	{9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
21	{9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
22	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
23	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
24	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
25	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
26	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
27	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
28	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
29	{9, 10, 11, 12, 14, 18, 19}	-1
30	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
31	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
32	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
33	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
34	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
35	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
36	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
37	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
38	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
39	{9, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
40	{9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
41	{9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
42	{9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
43	{9, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
44	{9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
45	{9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
46	{9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
47	{9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
48	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
49	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
50	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
51	{9, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
52	{9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
53	{9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
54	{9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
55	{9, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
56	{9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
57	{9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
58	{9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
59	{9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
60	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
61	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
62	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
63	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
64	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
65	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
66	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
67	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
68	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
69	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
70	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
71	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
72	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
73	{9, 10, 11, 12, 17, 15, 23, 19}	-1
74	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	-1
75	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	-1
76	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
77	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
78	{9, 10, 14, 18, 17, 15, 23, 19}	-1
79	{9, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
80	{9, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
81	{9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
82	{9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
83	{9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
84	{9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
85	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
86	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
87	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
88	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
89	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
90	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
91	{9, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
92	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
93	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
94	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
95	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
96	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
97	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
98	{9, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
99	{9, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
100	{9, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
101	{9, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
102	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
103	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
104	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
105	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
106	{9, 10, 11, 12, 17, 15, 24, 23, 19}	-1
107	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
108	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
109	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
110	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
111	{9, 10, 14, 18, 17, 15, 24, 23, 19}	-1
112	{9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
113	{9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
114	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
115	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
116	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
117	{9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
118	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
119	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
120	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
121	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
122	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
123	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
124	{9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
125	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
126	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
127	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
128	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
129	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
130	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
131	{9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
132	{9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
133	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
134	{9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
135	{9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
136	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
137	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
138	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
139	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
140	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
141	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
142	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
143	{9, 10, 11, 12, 17, 15, 25, 26, 19}	-1
144	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
145	{9, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
146	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
147	{9, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
148	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
149	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
150	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
151	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
152	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
153	{9, 10, 14, 18, 17, 15, 25, 26, 19}	-1
154	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
155	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
156	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
157	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
158	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
159	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
160	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
161	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
162	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
163	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
164	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
165	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
166	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
167	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
168	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
169	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
170	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
171	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
172	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
173	{9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
174	{9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
175	{9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
176	{9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
177	{9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
178	{9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
179	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
180	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
181	{9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
182	{9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
183	{9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
184	{9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
185	{9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
186	{9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
187	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
188	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
189	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
190	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
191	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
192	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
193	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
194	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
195	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
196	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
197	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
198	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
199	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
200	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
201	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
202	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
203	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
204	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
205	{9, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
206	{9, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
207	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
208	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
209	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
210	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
211	{9, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
212	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
213	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
214	{9, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
215	{9, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
216	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
217	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
218	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
219	{9, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
220	{9, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
221	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
222	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
223	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
224	{9, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
225	{9, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
226	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
227	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
228	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
229	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
230	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
231	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
232	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
233	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
234	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
235	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
236	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
237	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
238	{9, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
239	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
240	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
241	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
242	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
243	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
244	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
245	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
246	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
247	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
248	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
249	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
250	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
251	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
252	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
253	{9, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
254	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
255	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
256	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
257	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
258	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
259	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
260	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
261	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
262	{9, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
263	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
264	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
265	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
266	{9, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
267	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
268	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
269	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
270	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
271	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
272	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
273	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
274	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
275	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
276	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
277	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
278	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
279	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
280	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
281	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
282	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
283	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
284	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
285	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
286	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
287	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
288	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
289	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
290	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
291	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
292	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
293	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
294	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
295	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
296	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
297	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
298	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
299	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
300	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
301	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
302	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
303	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
304	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
305	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
306	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
307	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
308	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
309	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 19

#	Path	Direction
310	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
311	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
312	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
313	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
314	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
315	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
316	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
317	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
318	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
319	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
320	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
321	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
322	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
323	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
324	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
325	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 9 to element 27

#	Path	Direction
1	{9, 27}	1
2	{9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
3	{9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
5	{9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
6	{9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
7	{9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
9	{9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
10	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
11	{9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
12	{9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
13	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{9, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
15	{9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
16	{9, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
17	{9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
18	{9, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
19	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
20	{9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
21	{9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
23	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
24	{9, 7, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
25	{9, 7, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
26	{9, 7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
27	{9, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
28	{9, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
29	{9, 10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
30	{9, 10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 9 to element 27

#	Path	Direction
31	{9, 10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
32	{9, 10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
33	{9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
34	{9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
35	{9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
36	{9, 7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
37	{9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{9, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
39	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
40	{9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
41	{9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
43	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
44	{9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
45	{9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
47	{9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
48	{9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
49	{9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
51	{9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
53	{9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
55	{9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
56	{9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
57	{9, 7, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{9, 7, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
59	{9, 7, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
60	{9, 7, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
61	{9, 7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 9 to element 27

#	Path	Direction
62	{9, 7, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
63	{9, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
64	{9, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
65	{9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
66	{9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
67	{9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
68	{9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
69	{9, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
70	{9, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
71	{9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
72	{9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
73	{9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
74	{9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
75	{9, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
76	{9, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
77	{9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
78	{9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
79	{9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
80	{9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
81	{9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
82	{9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
83	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
84	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
85	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
86	{9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 10 to element 3

#	Path	Direction
1	{10, 11, 12, 1, 3}	-1
2	{10, 11, 12, 1, 23, 2, 3}	-1
3	{10, 11, 12, 1, 23, 7, 8, 2, 3}	1
4	{10, 14, 18, 19, 12, 1, 3}	1
5	{10, 14, 18, 19, 12, 1, 23, 2, 3}	1
6	{10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
7	{10, 11, 12, 17, 15, 23, 2, 3}	-1
8	{10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	1
9	{10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	1
10	{10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	-1
14	{10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	1
15	{10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
16	{10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
17	{10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	1
18	{10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
19	{10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
20	{10, 11, 12, 19, 24, 23, 2, 3}	1
21	{10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
22	{10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
23	{10, 14, 18, 19, 24, 23, 2, 3}	1
24	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
25	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
26	{10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
27	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
28	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
29	{10, 11, 12, 17, 15, 24, 23, 2, 3}	-1
30	{10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 10 to element 3

#	Path	Direction
31	{10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
32	{10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
33	{10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
34	{10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
35	{10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
36	{10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	1
37	{10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
38	{10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
39	{10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
40	{10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
41	{10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
42	{10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
43	{10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
44	{10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
45	{10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	-1
46	{10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
47	{10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
48	{10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
49	{10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
50	{10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
51	{10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
52	{10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
53	{10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
54	{10, 11, 12, 17, 15, 25, 26, 28, 3}	-1
55	{10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	1
56	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
57	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
58	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
59	{10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
60	{10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
61	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 10 to element 3

#	Path	Direction
62	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
63	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
64	{10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
65	{10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
66	{10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
67	{10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
68	{10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
69	{10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
70	{10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
71	{10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
72	{10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
73	{10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
74	{10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
75	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
76	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
77	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
78	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
79	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
80	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
81	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
82	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
83	{10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	-1
84	{10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
85	{10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
86	{10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	1
87	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	1
88	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
89	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
90	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	1
91	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
92	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 10 to element 3

#	Path	Direction
93	{10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
94	{10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
95	{10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
96	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
97	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
98	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
99	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
100	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
101	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
102	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	1
103	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
104	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
105	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
106	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
107	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
108	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
109	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
110	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
111	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
112	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
113	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	-1
114	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
115	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
116	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
117	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
118	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
119	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
120	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
121	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
122	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
123	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 10 to element 3

#	Path	Direction
124	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
125	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
126	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
127	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
128	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
129	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
130	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 10 to element 19

#	Path	Direction
1	{10, 11, 12, 19}	1
2	{10, 11, 12, 1, 23, 19}	-1
3	{10, 14, 18, 19}	1
4	{10, 11, 12, 14, 18, 19}	-1
5	{10, 11, 12, 17, 15, 23, 19}	-1
6	{10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	-1
7	{10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	-1
8	{10, 14, 18, 17, 15, 23, 19}	-1
9	{10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
10	{10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
11	{10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
12	{10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
13	{10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
14	{10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
15	{10, 11, 12, 14, 18, 17, 15, 23, 19}	1
16	{10, 11, 12, 17, 15, 24, 23, 19}	-1
17	{10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
18	{10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
19	{10, 14, 18, 17, 15, 24, 23, 19}	-1
20	{10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
21	{10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
22	{10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
23	{10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
24	{10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
25	{10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
26	{10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
27	{10, 11, 12, 17, 15, 25, 26, 19}	-1
28	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
29	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
30	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 10 to element 19

#	Path	Direction
31	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
32	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
33	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
34	{10, 14, 18, 17, 15, 25, 26, 19}	-1
35	{10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
36	{10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
37	{10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
38	{10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
39	{10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
40	{10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
41	{10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
42	{10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
43	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
44	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
45	{10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
46	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
47	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
48	{10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
49	{10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
50	{10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
51	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
52	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
53	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
54	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
55	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
56	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
57	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
58	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
59	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
60	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
61	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 10 to element 19

#	Path	Direction
62	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
63	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
64	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
65	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
66	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
67	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
68	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
69	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
70	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
71	{10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
72	{10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
73	{10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
74	{10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
75	{10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
76	{10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
77	{10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
78	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
79	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
80	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
81	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
82	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
83	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
84	{10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
85	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
86	{10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
87	{10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
88	{10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
89	{10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
90	{10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
91	{10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
92	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 10 to element 19

#	Path	Direction
93	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
94	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
95	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
96	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
97	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
98	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
99	{10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
100	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
101	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
102	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
103	{10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
104	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
105	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
106	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
107	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
108	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
109	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
110	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
111	{10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
112	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
113	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
114	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
115	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
116	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
117	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
118	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
119	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
120	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
121	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
122	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
123	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 10 to element 19

#	Path	Direction
124	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
125	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
126	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 10 to element 27

#	Path	Direction
1	{10, 11, 12, 17, 15, 25, 26, 28, 27}	1
2	{10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
3	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
12	{10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
14	{10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
15	{10, 14, 18, 17, 15, 25, 26, 28, 27}	1
16	{10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
17	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
18	{10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
20	{10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
21	{10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
22	{10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
23	{10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
24	{10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
25	{10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
26	{10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
27	{10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
28	{10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
30	{10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 10 to element 27

#	Path	Direction
31	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
34	{10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
36	{10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
37	{10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
38	{10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
39	{10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
40	{10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
41	{10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
42	{10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
43	{10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
44	{10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
45	{10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
46	{10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
47	{10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
48	{10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
49	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
50	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
51	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
52	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
53	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
54	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
55	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
56	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
57	{10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
58	{10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
59	{10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
60	{10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
61	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 10 to element 27

#	Path	Direction
62	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
63	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
64	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
65	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
66	{10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
67	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
68	{10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
69	{10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
70	{10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
71	{10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
72	{10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
73	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
74	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
75	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
76	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
77	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
78	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
79	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
80	{10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 11 to element 3

#	Path	Direction
1	{11, 12, 1, 3}	1
2	{11, 12, 1, 23, 2, 3}	1
3	{11, 12, 1, 23, 7, 8, 2, 3}	-1
4	{11, 12, 17, 15, 23, 2, 3}	1
5	{11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
6	{11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
7	{11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
8	{11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{11, 12, 19, 24, 23, 2, 3}	-1
14	{11, 12, 19, 24, 23, 7, 8, 1, 3}	1
15	{11, 12, 19, 24, 23, 7, 8, 2, 3}	1
16	{11, 12, 14, 18, 19, 24, 23, 2, 3}	1
17	{11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
18	{11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
19	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
20	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
21	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
22	{11, 12, 17, 15, 24, 23, 2, 3}	1
23	{11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
24	{11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
25	{11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
26	{11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
27	{11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
28	{11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
29	{11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
30	{11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 11 to element 3

#	Path	Direction
31	{11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
32	{11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
33	{11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
34	{11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
35	{11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
36	{11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
37	{11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
38	{11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
39	{11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
40	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
41	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
42	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
43	{11, 12, 17, 15, 25, 26, 28, 3}	1
44	{11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
45	{11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
46	{11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
47	{11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
48	{11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
49	{11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
50	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
51	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
52	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
53	{11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
54	{11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
55	{11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
56	{11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
57	{11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
58	{11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
59	{11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
60	{11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
61	{11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 11 to element 3

#	Path	Direction
62	{11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
63	{11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
64	{11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
65	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
66	{11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
67	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
68	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
69	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
70	{11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
71	{11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
72	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
73	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
74	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
75	{11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
76	{11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
77	{11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
78	{11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
79	{11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
80	{11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
81	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
82	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
83	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
84	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
85	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
86	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
87	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
88	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
89	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
90	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
91	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
92	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 11 to element 3

#	Path	Direction
93	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
94	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
95	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
96	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
97	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
98	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
99	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
100	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
101	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
102	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 11 to element 19

#	Path	Direction
1	{11, 12, 19}	-1
2	{11, 12, 1, 23, 19}	1
3	{11, 12, 14, 18, 19}	1
4	{11, 12, 1, 3, 13, 10, 14, 18, 19}	-1
5	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
6	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
7	{11, 12, 16, 13, 10, 14, 18, 19}	1
8	{11, 12, 17, 15, 23, 19}	1
9	{11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
10	{11, 12, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
11	{11, 12, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
12	{11, 12, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
13	{11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
14	{11, 12, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
15	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
16	{11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
17	{11, 12, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
18	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
19	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
20	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
21	{11, 12, 14, 18, 17, 15, 23, 19}	-1
22	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
23	{11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
24	{11, 12, 17, 15, 24, 23, 19}	1
25	{11, 12, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
26	{11, 12, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
27	{11, 12, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
28	{11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
29	{11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
30	{11, 12, 14, 18, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 11 to element 19

#	Path	Direction
31	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
32	{11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
33	{11, 12, 17, 15, 25, 26, 19}	1
34	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
35	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
36	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
37	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
38	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
39	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
40	{11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
41	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
42	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
43	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
44	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
45	{11, 12, 17, 15, 25, 26, 28, 19}	1
46	{11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
47	{11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
48	{11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
49	{11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
50	{11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
51	{11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
52	{11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
53	{11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
54	{11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
55	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
56	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
57	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
58	{11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
59	{11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
60	{11, 12, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
61	{11, 12, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 11 to element 19

#	Path	Direction
62	{11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
63	{11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
64	{11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
65	{11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
66	{11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
67	{11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
68	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
69	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
70	{11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
71	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
72	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
73	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
74	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
75	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
76	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
77	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
78	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
79	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
80	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
81	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
82	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
83	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
84	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
85	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
86	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
87	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
88	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
89	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
90	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
91	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
92	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 11 to element 19

#	Path	Direction
93	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
94	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
95	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
96	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
97	{11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
98	{11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
99	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
100	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
101	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
102	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
103	{11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
104	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
105	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
106	{11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
107	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
108	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
109	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
110	{11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
111	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
112	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
113	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
114	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
115	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
116	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
117	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
118	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
119	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
120	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
121	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
122	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
123	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 11 to element 19

#	Path	Direction
124	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
125	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
126	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
127	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
128	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
129	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
130	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
131	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
132	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
133	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
134	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
135	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
136	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 11 to element 27

#	Path	Direction
1	{11, 12, 17, 15, 25, 26, 28, 27}	-1
2	{11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
3	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
12	{11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
14	{11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
16	{11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
17	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
18	{11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
19	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
20	{11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
21	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
22	{11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
23	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
24	{11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
25	{11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
26	{11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
27	{11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
28	{11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
30	{11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 11 to element 27

#	Path	Direction
31	{11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
32	{11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
33	{11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
34	{11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
36	{11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
37	{11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
40	{11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
41	{11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
44	{11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
45	{11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
46	{11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
47	{11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
48	{11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
49	{11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
50	{11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
51	{11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
52	{11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
53	{11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
54	{11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
55	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
56	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
57	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
58	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
59	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
60	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
61	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 11 to element 27

#	Path	Direction
62	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
63	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
64	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
65	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
66	{11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 12 to element 3

#	Path	Direction
1	{12, 1, 3}	1
2	{12, 1, 23, 2, 3}	1
3	{12, 1, 23, 7, 8, 2, 3}	-1
4	{12, 17, 15, 23, 2, 3}	1
5	{12, 17, 15, 23, 7, 8, 1, 3}	-1
6	{12, 17, 15, 23, 7, 8, 2, 3}	-1
7	{12, 14, 18, 17, 15, 23, 2, 3}	-1
8	{12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{12, 19, 24, 23, 2, 3}	-1
14	{12, 19, 24, 23, 7, 8, 1, 3}	1
15	{12, 19, 24, 23, 7, 8, 2, 3}	1
16	{12, 14, 18, 19, 24, 23, 2, 3}	1
17	{12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
18	{12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
19	{12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
20	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
21	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
22	{12, 17, 15, 24, 23, 2, 3}	1
23	{12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
24	{12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
25	{12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
26	{12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
27	{12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
28	{12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
29	{12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
30	{12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 12 to element 3

#	Path	Direction
31	{12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
32	{12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
33	{12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
34	{12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
35	{12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
36	{12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
37	{12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
38	{12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
39	{12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
40	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
41	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
42	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
43	{12, 17, 15, 25, 26, 28, 3}	1
44	{12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
45	{12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
46	{12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
47	{12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
48	{12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
49	{12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
50	{12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
51	{12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
52	{12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
53	{12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
54	{12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
55	{12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
56	{12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
57	{12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
58	{12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
59	{12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
60	{12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
61	{12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 12 to element 3

#	Path	Direction
62	{12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
63	{12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
64	{12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
65	{12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
66	{12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
67	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
68	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
69	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
70	{12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
71	{12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
72	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
73	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
74	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
75	{12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
76	{12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
77	{12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
78	{12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
79	{12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
80	{12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
81	{12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
82	{12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
83	{12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
84	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
85	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
86	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
87	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
88	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
89	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
90	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
91	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
92	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 12 to element 3

#	Path	Direction
93	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
94	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
95	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
96	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
97	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
98	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
99	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
100	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
101	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
102	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 12 to element 19

#	Path	Direction
1	{12, 19}	-1
2	{12, 1, 23, 19}	1
3	{12, 14, 18, 19}	1
4	{12, 1, 3, 13, 10, 14, 18, 19}	-1
5	{12, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
6	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
7	{12, 16, 13, 10, 14, 18, 19}	1
8	{12, 17, 15, 23, 19}	1
9	{12, 17, 15, 13, 10, 14, 18, 19}	-1
10	{12, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
11	{12, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
12	{12, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
13	{12, 1, 3, 20, 5, 17, 15, 23, 19}	1
14	{12, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
15	{12, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
16	{12, 1, 3, 22, 5, 17, 15, 23, 19}	1
17	{12, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
18	{12, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
19	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
20	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
21	{12, 14, 18, 17, 15, 23, 19}	-1
22	{12, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
23	{12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
24	{12, 17, 15, 24, 23, 19}	1
25	{12, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
26	{12, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
27	{12, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
28	{12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
29	{12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
30	{12, 14, 18, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 12 to element 19

#	Path	Direction
31	{12, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
32	{12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
33	{12, 17, 15, 25, 26, 19}	1
34	{12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
35	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
36	{12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
37	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
38	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
39	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
40	{12, 14, 18, 17, 15, 25, 26, 19}	-1
41	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
42	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
43	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
44	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
45	{12, 17, 15, 25, 26, 28, 19}	1
46	{12, 17, 15, 25, 26, 28, 23, 19}	-1
47	{12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
48	{12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
49	{12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
50	{12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
51	{12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
52	{12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
53	{12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
54	{12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
55	{12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
56	{12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
57	{12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
58	{12, 17, 15, 25, 26, 28, 27, 19}	-1
59	{12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
60	{12, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
61	{12, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 12 to element 19

#	Path	Direction
62	{12, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
63	{12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
64	{12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
65	{12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
66	{12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
67	{12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
68	{12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
69	{12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
70	{12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
71	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
72	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
73	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
74	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
75	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
76	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
77	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
78	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
79	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
80	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
81	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
82	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
83	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
84	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
85	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
86	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
87	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
88	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
89	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
90	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
91	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
92	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 12 to element 19

#	Path	Direction
93	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
94	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
95	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
96	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
97	{12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
98	{12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
99	{12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
100	{12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
101	{12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
102	{12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
103	{12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
104	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
105	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
106	{12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
107	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
108	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
109	{12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
110	{12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
111	{12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
112	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
113	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
114	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
115	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
116	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
117	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
118	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
119	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
120	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
121	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
122	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
123	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1

Appendix 4_Paths of the system_From element 12 to element 19

#	Path	Direction
124	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
125	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
126	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
127	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
128	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
129	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
130	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
131	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
132	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
133	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
134	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
135	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
136	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 12 to element 27

#	Path	Direction
1	{12, 17, 15, 25, 26, 28, 27}	-1
2	{12, 17, 15, 25, 26, 28, 9, 27}	-1
3	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
12	{12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
14	{12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{12, 14, 18, 17, 15, 25, 26, 28, 27}	1
16	{12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
17	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
18	{12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
19	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
20	{12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
21	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
22	{12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
23	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
24	{12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
25	{12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
26	{12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
27	{12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
28	{12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
30	{12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 12 to element 27

#	Path	Direction
31	{12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
32	{12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
33	{12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
34	{12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
36	{12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
37	{12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
40	{12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
41	{12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
44	{12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
45	{12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
46	{12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
47	{12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
48	{12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
49	{12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
50	{12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
51	{12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
52	{12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
53	{12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
54	{12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
55	{12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
56	{12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
57	{12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
58	{12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
59	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
60	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
61	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 12 to element 27

#	Path	Direction
62	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
63	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
64	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
65	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
66	{12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 13 to element 3

#	Path	Direction
1	{13, 10, 11, 12, 1, 3}	1
2	{13, 10, 11, 12, 1, 23, 2, 3}	1
3	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
4	{13, 10, 14, 18, 19, 12, 1, 3}	-1
5	{13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
6	{13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
7	{13, 10, 11, 12, 17, 15, 23, 2, 3}	1
8	{13, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
9	{13, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
10	{13, 10, 14, 18, 17, 15, 23, 2, 3}	1
11	{13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
12	{13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
13	{13, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	1
14	{13, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	-1
15	{13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
16	{13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
17	{13, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
18	{13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
19	{13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
20	{13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
21	{13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
22	{13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
23	{13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
24	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
25	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
26	{13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
27	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
28	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
29	{13, 10, 11, 12, 17, 15, 24, 23, 2, 3}	1
30	{13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 13 to element 3

#	Path	Direction
31	{13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
32	{13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
33	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
34	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
35	{13, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	1
36	{13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	-1
37	{13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
38	{13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
39	{13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
40	{13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
41	{13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
42	{13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
43	{13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
44	{13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
45	{13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	1
46	{13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1
47	{13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
48	{13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
49	{13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
50	{13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
51	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
52	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
53	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
54	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3}	1
55	{13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
56	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
57	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
58	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
59	{13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
60	{13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
61	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 13 to element 3

#	Path	Direction
62	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
63	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
64	{13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
65	{13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
66	{13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
67	{13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
68	{13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
69	{13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
70	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
71	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
72	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
73	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1
74	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	-1
75	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
76	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
77	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
78	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
79	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
80	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
81	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
82	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
83	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	1
84	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	1
85	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
86	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	-1
87	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	-1
88	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
89	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
90	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	-1
91	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
92	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 13 to element 3

#	Path	Direction
93	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
94	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
95	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
96	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
97	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
98	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
99	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
100	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
101	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
102	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	-1
103	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	1
104	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
105	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
106	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
107	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
108	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
109	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
110	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
111	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
112	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
113	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
114	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
115	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
116	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
117	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
118	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
119	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
120	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
121	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
122	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
123	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 13 to element 3

#	Path	Direction
124	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
125	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
126	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
127	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
128	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
129	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
130	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 13 to element 19

#	Path	Direction
1	{13, 10, 11, 12, 19}	-1
2	{13, 10, 11, 12, 1, 23, 19}	1
3	{13, 10, 14, 18, 19}	-1
4	{13, 10, 11, 12, 14, 18, 19}	1
5	{13, 10, 11, 12, 17, 15, 23, 19}	1
6	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
7	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
8	{13, 10, 14, 18, 17, 15, 23, 19}	1
9	{13, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	-1
10	{13, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	-1
11	{13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
12	{13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
13	{13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
14	{13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
15	{13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
16	{13, 10, 11, 12, 17, 15, 24, 23, 19}	1
17	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
18	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
19	{13, 10, 14, 18, 17, 15, 24, 23, 19}	1
20	{13, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	-1
21	{13, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	-1
22	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
23	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
24	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
25	{13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
26	{13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
27	{13, 10, 11, 12, 17, 15, 25, 26, 19}	1
28	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
29	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
30	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 13 to element 19

#	Path	Direction
31	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
32	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
33	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
34	{13, 10, 14, 18, 17, 15, 25, 26, 19}	1
35	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
36	{13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
37	{13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
38	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
39	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
40	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
41	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
42	{13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
43	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
44	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
45	{13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
46	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
47	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
48	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
49	{13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
50	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
51	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
52	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
53	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
54	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
55	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
56	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
57	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
58	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
59	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
60	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
61	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 13 to element 19

#	Path	Direction
62	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
63	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
64	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
65	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
66	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
67	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
68	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
69	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
70	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
71	{13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
72	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
73	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
74	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
75	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
76	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
77	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
78	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
79	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
80	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
81	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
82	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
83	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
84	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
85	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
86	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	-1
87	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	1
88	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	1
89	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	-1
90	{13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	1
91	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	1
92	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 13 to element 19

#	Path	Direction
93	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
94	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
95	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
96	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
97	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
98	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
99	{13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
100	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
101	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
102	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
103	{13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
104	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
105	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
106	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
107	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
108	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
109	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
110	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
111	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
112	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
113	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
114	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
115	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
116	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
117	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
118	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
119	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
120	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
121	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
122	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
123	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1

Appendix 4_Paths of the system_From element 13 to element 19

#	Path	Direction
124	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
125	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
126	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 13 to element 27

#	Path	Direction
1	{13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
2	{13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
3	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
12	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
14	{13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
16	{13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
17	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
18	{13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{13, 10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
20	{13, 10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
21	{13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
22	{13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
23	{13, 10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
24	{13, 10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
25	{13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
26	{13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
27	{13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
28	{13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
29	{13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
30	{13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 13 to element 27

#	Path	Direction
31	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
32	{13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
33	{13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
34	{13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
35	{13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
36	{13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
37	{13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
38	{13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
39	{13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
40	{13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
41	{13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
42	{13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
43	{13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
44	{13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
45	{13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
46	{13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
47	{13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
48	{13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
49	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
50	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
51	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
52	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
53	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
54	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
55	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
56	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
57	{13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
58	{13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
59	{13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
60	{13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
61	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 13 to element 27

#	Path	Direction
62	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
63	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
64	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
65	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
66	{13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
67	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
68	{13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
69	{13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
70	{13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
71	{13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
72	{13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
73	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
74	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
75	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
76	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
77	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
78	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
79	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
80	{13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 14 to element 3

#	Path	Direction
1	{14, 18, 16, 13, 10, 11, 12, 1, 3}	1
2	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3}	1
3	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
4	{14, 18, 19, 12, 1, 3}	1
5	{14, 18, 19, 12, 1, 23, 2, 3}	1
6	{14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
7	{14, 18, 17, 15, 23, 2, 3}	-1
8	{14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{14, 18, 17, 15, 13, 10, 11, 12, 1, 3}	-1
11	{14, 18, 17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	-1
12	{14, 18, 17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
13	{14, 18, 17, 15, 23, 19, 12, 1, 3}	-1
14	{14, 18, 16, 13, 10, 11, 12, 17, 15, 23, 2, 3}	1
15	{14, 18, 16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
16	{14, 18, 16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
17	{14, 18, 19, 12, 17, 15, 23, 2, 3}	1
18	{14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
19	{14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
20	{14, 18, 19, 24, 23, 2, 3}	1
21	{14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
22	{14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
23	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
24	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
25	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
26	{14, 18, 17, 15, 24, 23, 2, 3}	-1
27	{14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
28	{14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
29	{14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
30	{14, 18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 14 to element 3

#	Path	Direction
31	{14, 18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
32	{14, 18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
33	{14, 18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 2, 3}	1
34	{14, 18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
35	{14, 18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
36	{14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	1
37	{14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
38	{14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
39	{14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	-1
40	{14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
41	{14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
42	{14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
43	{14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
44	{14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
45	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
46	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
47	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
48	{14, 18, 17, 15, 25, 26, 28, 3}	-1
49	{14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
50	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
51	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
52	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
53	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
54	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
55	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
56	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
57	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
58	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	-1
59	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	-1
60	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
61	{14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	-1

Appendix 4_Paths of the system_From element 14 to element 3

#	Path	Direction
62	{14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
63	{14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
64	{14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	1
65	{14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	1
66	{14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
67	{14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
68	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	1
69	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
70	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
71	{14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
72	{14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
73	{14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
74	{14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
75	{14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
76	{14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
77	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
78	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
79	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
80	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	1
81	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
82	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
83	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3}	1
84	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
85	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
86	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
87	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
88	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
89	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
90	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
91	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
92	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 14 to element 3

#	Path	Direction
93	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
94	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
95	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
96	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
97	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
98	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
99	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
100	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
101	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
102	{14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	1
103	{14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
104	{14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
105	{14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
106	{14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
107	{14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
108	{14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
109	{14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
110	{14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
111	{14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 14 to element 19

#	Path	Direction
1	{14, 18, 19}	1
2	{14, 18, 16, 13, 10, 11, 12, 19}	-1
3	{14, 18, 16, 13, 10, 11, 12, 1, 23, 19}	1
4	{14, 18, 17, 15, 23, 19}	-1
5	{14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
6	{14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
7	{14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
8	{14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
9	{14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
10	{14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
11	{14, 18, 17, 15, 13, 10, 11, 12, 19}	1
12	{14, 18, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
13	{14, 18, 17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	1
14	{14, 18, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
15	{14, 18, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
16	{14, 18, 16, 13, 10, 11, 12, 17, 15, 23, 19}	1
17	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
18	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
19	{14, 18, 17, 15, 24, 23, 19}	-1
20	{14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
21	{14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
22	{14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
23	{14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
24	{14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
25	{14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
26	{14, 18, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	1
27	{14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
28	{14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
29	{14, 18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
30	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 14 to element 19

#	Path	Direction
31	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
32	{14, 18, 17, 15, 25, 26, 19}	-1
33	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
34	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
35	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
36	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
37	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
38	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
39	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
40	{14, 18, 17, 15, 25, 26, 28, 19}	-1
41	{14, 18, 17, 15, 25, 26, 28, 23, 19}	1
42	{14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
43	{14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
44	{14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
45	{14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
46	{14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
47	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
48	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
49	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
50	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
51	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
52	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
53	{14, 18, 17, 15, 25, 26, 28, 27, 19}	1
54	{14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
55	{14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
56	{14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
57	{14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
58	{14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
59	{14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
60	{14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
61	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 14 to element 19

#	Path	Direction
62	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
63	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
64	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
65	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
66	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
67	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
68	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
69	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
70	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
71	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
72	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
73	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
74	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
75	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
76	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
77	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
78	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
79	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
80	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
81	{14, 18, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	1
82	{14, 18, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	-1
83	{14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	-1
84	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
85	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
86	{14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
87	{14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
88	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
89	{14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
90	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
91	{14, 18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
92	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 14 to element 19

#	Path	Direction
93	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
94	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
95	{14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
96	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
97	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
98	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
99	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
100	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
101	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
102	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
103	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
104	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
105	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
106	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
107	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
108	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
109	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
110	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
111	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
112	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
113	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
114	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
115	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
116	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
117	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
118	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
119	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
120	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
121	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
122	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
123	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 14 to element 19

#	Path	Direction
124	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
125	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
126	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
127	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
128	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
129	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
130	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 14 to element 27

#	Path	Direction
1	{14, 18, 17, 15, 25, 26, 28, 27}	1
2	{14, 18, 17, 15, 25, 26, 28, 9, 27}	1
3	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
4	{14, 18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
5	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{14, 18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
8	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{14, 18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{14, 18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
14	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
16	{14, 18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
17	{14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
18	{14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
20	{14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
21	{14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
22	{14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
23	{14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
24	{14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
25	{14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
26	{14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
27	{14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
28	{14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
30	{14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 14 to element 27

#	Path	Direction
31	{14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
32	{14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
33	{14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
34	{14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
36	{14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
37	{14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
38	{14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
39	{14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
40	{14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
41	{14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
42	{14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
43	{14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
44	{14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
46	{14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
47	{14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
48	{14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
50	{14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
51	{14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
52	{14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
53	{14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
54	{14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
55	{14, 18, 19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
56	{14, 18, 19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
57	{14, 18, 19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
58	{14, 18, 19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
59	{14, 18, 19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
60	{14, 18, 19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
61	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 14 to element 27

#	Path	Direction
62	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
63	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
64	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
65	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
66	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
67	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
68	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
69	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
70	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
71	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
72	{14, 18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 15 to element 3

#	Path	Direction
1	{15, 23, 2, 3}	-1
2	{15, 23, 7, 8, 1, 3}	1
3	{15, 23, 7, 8, 2, 3}	1
4	{15, 13, 10, 11, 12, 1, 3}	-1
5	{15, 13, 10, 11, 12, 1, 23, 2, 3}	-1
6	{15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
7	{15, 23, 19, 12, 1, 3}	-1
8	{15, 13, 10, 14, 18, 19, 12, 1, 3}	1
9	{15, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	1
10	{15, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
11	{15, 24, 23, 2, 3}	-1
12	{15, 24, 23, 7, 8, 1, 3}	1
13	{15, 24, 23, 7, 8, 2, 3}	1
14	{15, 24, 23, 19, 12, 1, 3}	-1
15	{15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	1
16	{15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
17	{15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
18	{15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
19	{15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
20	{15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
21	{15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
22	{15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
23	{15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
24	{15, 25, 26, 19, 12, 1, 3}	-1
25	{15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
26	{15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
27	{15, 25, 26, 19, 24, 23, 2, 3}	-1
28	{15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
29	{15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
30	{15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 15 to element 3

#	Path	Direction
31	{15, 25, 26, 28, 23, 2, 3}	1
32	{15, 25, 26, 28, 7, 8, 1, 3}	1
33	{15, 25, 26, 28, 7, 8, 2, 3}	1
34	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
35	{15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
36	{15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
37	{15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
38	{15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
39	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
40	{15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	-1
41	{15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	-1
42	{15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
43	{15, 25, 26, 28, 19, 12, 1, 3}	-1
44	{15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
45	{15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
46	{15, 25, 26, 28, 23, 19, 12, 1, 3}	1
47	{15, 25, 26, 28, 27, 19, 12, 1, 3}	1
48	{15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
49	{15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
50	{15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	1
51	{15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
52	{15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
53	{15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	1
54	{15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	1
55	{15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
56	{15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
57	{15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
58	{15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
59	{15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
60	{15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
61	{15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 15 to element 3

#	Path	Direction
62	{15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
63	{15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
64	{15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
65	{15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	1
66	{15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
67	{15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
68	{15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	1
69	{15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
70	{15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
71	{15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
72	{15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
73	{15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
1	{15, 23, 19}	-1
2	{15, 23, 2, 3, 20, 5, 11, 12, 19}	1
3	{15, 23, 2, 3, 22, 5, 11, 12, 19}	1
4	{15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
5	{15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
6	{15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
7	{15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
8	{15, 13, 10, 11, 12, 19}	1
9	{15, 13, 10, 11, 12, 1, 23, 19}	-1
10	{15, 23, 2, 3, 13, 10, 11, 12, 19}	1
11	{15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
12	{15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
13	{15, 13, 10, 14, 18, 19}	1
14	{15, 23, 2, 3, 13, 10, 14, 18, 19}	1
15	{15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
16	{15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
17	{15, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
18	{15, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
19	{15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
20	{15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
21	{15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
22	{15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
23	{15, 13, 10, 11, 12, 14, 18, 19}	-1
24	{15, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
25	{15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
26	{15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
27	{15, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
28	{15, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
29	{15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
30	{15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
31	{15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
32	{15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
33	{15, 24, 23, 19}	-1
34	{15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
35	{15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
36	{15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
37	{15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
38	{15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
39	{15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
40	{15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	1
41	{15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
42	{15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
43	{15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	1
44	{15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
45	{15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
46	{15, 24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
47	{15, 24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
48	{15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
49	{15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
50	{15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
51	{15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
52	{15, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
53	{15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
54	{15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
55	{15, 24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
56	{15, 24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
57	{15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
58	{15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
59	{15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
60	{15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
61	{15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
62	{15, 25, 26, 28, 19}	-1
63	{15, 25, 26, 28, 23, 19}	1
64	{15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
65	{15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
66	{15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
67	{15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
68	{15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
69	{15, 25, 26, 28, 7, 8, 1, 23, 19}	1
70	{15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
71	{15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
72	{15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
73	{15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
74	{15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
75	{15, 25, 26, 28, 27, 19}	1
76	{15, 25, 26, 28, 9, 27, 19}	1
77	{15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
78	{15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
79	{15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
80	{15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
81	{15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
82	{15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
83	{15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
84	{15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
85	{15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
86	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
87	{15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
88	{15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
89	{15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
90	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
91	{15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
92	{15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
93	{15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
94	{15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
95	{15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
96	{15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
97	{15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
98	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
99	{15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
100	{15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
101	{15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
102	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
103	{15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	1
104	{15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	-1
105	{15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	-1
106	{15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
107	{15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
108	{15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
109	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
110	{15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
111	{15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
112	{15, 25, 26, 28, 9, 10, 11, 12, 19}	1
113	{15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
114	{15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
115	{15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
116	{15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
117	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
118	{15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	1
119	{15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	-1
120	{15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
121	{15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
122	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
123	{15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
124	{15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
125	{15, 25, 26, 28, 9, 10, 14, 18, 19}	1
126	{15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
127	{15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
128	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
129	{15, 25, 26, 28, 3, 20, 5, 11, 12, 14, 18, 19}	-1
130	{15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
131	{15, 25, 26, 28, 3, 22, 5, 11, 12, 14, 18, 19}	-1
132	{15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
133	{15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
134	{15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
135	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
136	{15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
137	{15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
138	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
139	{15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
140	{15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
141	{15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
142	{15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
143	{15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
144	{15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
145	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
146	{15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
147	{15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
148	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
149	{15, 25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	-1
150	{15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
151	{15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
152	{15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
153	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
154	{15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 15 to element 19

#	Path	Direction
155	{15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
156	{15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
157	{15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
158	{15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
159	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
160	{15, 25, 26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
161	{15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
162	{15, 25, 26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
163	{15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
164	{15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
165	{15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
166	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
167	{15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
168	{15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
169	{15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
170	{15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
171	{15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
172	{15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
173	{15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
174	{15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
175	{15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
176	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
177	{15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
178	{15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
179	{15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 15 to element 27

#	Path	Direction
1	{15, 25, 26, 28, 27}	1
2	{15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 16 to element 3

#	Path	Direction
1	{16, 13, 10, 11, 12, 1, 3}	-1
2	{16, 13, 10, 11, 12, 1, 23, 2, 3}	-1
3	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
4	{16, 13, 10, 14, 18, 19, 12, 1, 3}	1
5	{16, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	1
6	{16, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
7	{16, 13, 10, 11, 12, 17, 15, 23, 2, 3}	-1
8	{16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	1
9	{16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	1
10	{16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{16, 13, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	-1
14	{16, 13, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	1
15	{16, 13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
16	{16, 13, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
17	{16, 13, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	1
18	{16, 13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
19	{16, 13, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
20	{16, 13, 10, 11, 12, 19, 24, 23, 2, 3}	1
21	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
22	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
23	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
24	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
25	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
26	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
27	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
28	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
29	{16, 13, 10, 11, 12, 17, 15, 24, 23, 2, 3}	-1
30	{16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 16 to element 3

#	Path	Direction
31	{16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
32	{16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
33	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
34	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
35	{16, 13, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
36	{16, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	1
37	{16, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
38	{16, 13, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
39	{16, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
40	{16, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
41	{16, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
42	{16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
43	{16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
44	{16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
45	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	-1
46	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
47	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
48	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
49	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
50	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
51	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
52	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
53	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
54	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3}	-1
55	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	1
56	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
57	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
58	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
59	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
60	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
61	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 16 to element 3

#	Path	Direction
62	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
63	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
64	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
65	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
66	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
67	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
68	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
69	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
70	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
71	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
72	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
73	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
74	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
75	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
76	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
77	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
78	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
79	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
80	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
81	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
82	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
83	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	-1
84	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
85	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
86	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	1
87	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	1
88	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
89	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
90	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	1
91	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
92	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 16 to element 3

#	Path	Direction
93	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
94	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
95	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
96	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
97	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
98	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
99	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
100	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
101	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
102	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 3}	1
103	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
104	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
105	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
106	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
107	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
108	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
109	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
110	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
111	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
112	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
113	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	-1
114	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
115	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
116	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
117	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
118	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
119	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
120	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
121	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
122	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
123	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 16 to element 3

#	Path	Direction
124	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
125	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
126	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
127	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
128	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
129	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
130	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 16 to element 19

#	Path	Direction
1	{16, 13, 10, 11, 12, 19}	1
2	{16, 13, 10, 11, 12, 1, 23, 19}	-1
3	{16, 13, 10, 14, 18, 19}	1
4	{16, 13, 10, 11, 12, 14, 18, 19}	-1
5	{16, 13, 10, 11, 12, 17, 15, 23, 19}	-1
6	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	-1
7	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	-1
8	{16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
9	{16, 13, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
10	{16, 13, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
11	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
12	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
13	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
14	{16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
15	{16, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
16	{16, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
17	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
18	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
19	{16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
20	{16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
21	{16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
22	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
23	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
24	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
25	{16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
26	{16, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
27	{16, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
28	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
29	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
30	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 16 to element 19

#	Path	Direction
31	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
32	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
33	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
34	{16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
35	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
36	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
37	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
38	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
39	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
40	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
41	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
42	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
43	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
44	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
45	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
46	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
47	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
48	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
49	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
50	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
51	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
52	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
53	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
54	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
55	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
56	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
57	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
58	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
59	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
60	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
61	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 16 to element 19

#	Path	Direction
62	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
63	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
64	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
65	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
66	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
67	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
68	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
69	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
70	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
71	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
72	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
73	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
74	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
75	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
76	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
77	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
78	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
79	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
80	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
81	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
82	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
83	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
84	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
85	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
86	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
87	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
88	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
89	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
90	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
91	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
92	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 16 to element 19

#	Path	Direction
93	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
94	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
95	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
96	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
97	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
98	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
99	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
100	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
101	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
102	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
103	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
104	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
105	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
106	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19	-1
107	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19	1
108	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
109	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
110	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19	-1
111	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19	1
112	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
113	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
114	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
115	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
116	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
117	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
118	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
119	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
120	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
121	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
122	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
123	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 16 to element 19

#	Path	Direction
124	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23,	-1
125	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
126	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 16 to element 27

#	Path	Direction
1	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
2	{16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
3	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
12	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
14	{16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
15	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
16	{16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
17	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
18	{16, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{16, 13, 10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
20	{16, 13, 10, 14, 18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
21	{16, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
22	{16, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
23	{16, 13, 10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
24	{16, 13, 10, 14, 18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
25	{16, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
26	{16, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
27	{16, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
28	{16, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{16, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
30	{16, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 16 to element 27

#	Path	Direction
31	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{16, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
34	{16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
36	{16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
37	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
38	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
39	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
40	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
41	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
42	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
43	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
44	{16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
45	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
46	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
47	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
48	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
49	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
50	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
51	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
52	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
53	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
54	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
55	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
56	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
57	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
58	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
59	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
60	{16, 13, 10, 14, 18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
61	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 16 to element 27

#	Path	Direction
62	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
63	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
64	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
65	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
66	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
67	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
68	{16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
69	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
70	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
71	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
72	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
73	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
74	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
75	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
76	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
77	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
78	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
79	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
80	{16, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 17 to element 3

#	Path	Direction
1	{17, 15, 23, 2, 3}	1
2	{17, 15, 23, 7, 8, 1, 3}	-1
3	{17, 15, 23, 7, 8, 2, 3}	-1
4	{17, 15, 13, 10, 11, 12, 1, 3}	1
5	{17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	1
6	{17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
7	{17, 15, 23, 19, 12, 1, 3}	1
8	{17, 15, 13, 10, 14, 18, 19, 12, 1, 3}	-1
9	{17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
10	{17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
11	{17, 15, 24, 23, 2, 3}	1
12	{17, 15, 24, 23, 7, 8, 1, 3}	-1
13	{17, 15, 24, 23, 7, 8, 2, 3}	-1
14	{17, 15, 24, 23, 19, 12, 1, 3}	1
15	{17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
16	{17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
17	{17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
18	{17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
19	{17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
20	{17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
21	{17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
22	{17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
23	{17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
24	{17, 15, 25, 26, 19, 12, 1, 3}	1
25	{17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1
26	{17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
27	{17, 15, 25, 26, 19, 24, 23, 2, 3}	1
28	{17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
29	{17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
30	{17, 15, 25, 26, 28, 3}	1

Appendix 4_Paths of the system_From element 17 to element 3

#	Path	Direction
31	{17, 15, 25, 26, 28, 23, 2, 3}	-1
32	{17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
33	{17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
34	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
35	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
36	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
37	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
38	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
39	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
40	{17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	1
41	{17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	1
42	{17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
43	{17, 15, 25, 26, 28, 19, 12, 1, 3}	1
44	{17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	1
45	{17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
46	{17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	-1
47	{17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	-1
48	{17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
49	{17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
50	{17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	-1
51	{17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
52	{17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
53	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
54	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
55	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
56	{17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
57	{17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
58	{17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
59	{17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
60	{17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
61	{17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 17 to element 3

#	Path	Direction
62	{17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
63	{17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
64	{17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
65	{17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
66	{17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
67	{17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
68	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
69	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
70	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
71	{17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
72	{17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
73	{17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
1	{17, 15, 23, 19}	1
2	{17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	-1
3	{17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	-1
4	{17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
5	{17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
6	{17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
7	{17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
8	{17, 15, 13, 10, 11, 12, 19}	-1
9	{17, 15, 13, 10, 11, 12, 1, 23, 19}	1
10	{17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	-1
11	{17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
12	{17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
13	{17, 15, 13, 10, 14, 18, 19}	-1
14	{17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
15	{17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
16	{17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
17	{17, 15, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
18	{17, 15, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
19	{17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
20	{17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
21	{17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
22	{17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
23	{17, 15, 13, 10, 11, 12, 14, 18, 19}	1
24	{17, 15, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
25	{17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
26	{17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
27	{17, 15, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
28	{17, 15, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
29	{17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
30	{17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
31	{17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
32	{17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
33	{17, 15, 24, 23, 19}	1
34	{17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	-1
35	{17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	-1
36	{17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
37	{17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
38	{17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
39	{17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
40	{17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	-1
41	{17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
42	{17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
43	{17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
44	{17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
45	{17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
46	{17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
47	{17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
48	{17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
49	{17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
50	{17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
51	{17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
52	{17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
53	{17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
54	{17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
55	{17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
56	{17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
57	{17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
58	{17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
59	{17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
60	{17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
61	{17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
62	{17, 15, 25, 26, 28, 19}	1
63	{17, 15, 25, 26, 28, 23, 19}	-1
64	{17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
65	{17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
66	{17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
67	{17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
68	{17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
69	{17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
70	{17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
71	{17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
72	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
73	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
74	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
75	{17, 15, 25, 26, 28, 27, 19}	-1
76	{17, 15, 25, 26, 28, 9, 27, 19}	-1
77	{17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	-1
78	{17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	1
79	{17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	1
80	{17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	-1
81	{17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	1
82	{17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	1
83	{17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
84	{17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
85	{17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
86	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
87	{17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
88	{17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
89	{17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
90	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
91	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
92	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
93	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
94	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
95	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
96	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
97	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
98	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
99	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
100	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
101	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
102	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
103	{17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	-1
104	{17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	1
105	{17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	1
106	{17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
107	{17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
108	{17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
109	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
110	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
111	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
112	{17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
113	{17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
114	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
115	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
116	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
117	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
118	{17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
119	{17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
120	{17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
121	{17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
122	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
123	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
124	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
125	{17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
126	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
127	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
128	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
129	{17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 14, 18, 19}	1
130	{17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
131	{17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 14, 18, 19}	1
132	{17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
133	{17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
134	{17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
135	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
136	{17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
137	{17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
138	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
139	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
140	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
141	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
142	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
143	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
144	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
145	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
146	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
147	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
148	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
149	{17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	1
150	{17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
151	{17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
152	{17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
153	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
154	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 17 to element 19

#	Path	Direction
155	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
156	{17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
157	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
158	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
159	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
160	{17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
161	{17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
162	{17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
163	{17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
164	{17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
165	{17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
166	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
167	{17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
168	{17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
169	{17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
170	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
171	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
172	{17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
173	{17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
174	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
175	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
176	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
177	{17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
178	{17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
179	{17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 17 to element 27

#	Path	Direction
1	{17, 15, 25, 26, 28, 27}	-1
2	{17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 18 to element 3

#	Path	Direction
1	{18, 16, 13, 10, 11, 12, 1, 3}	1
2	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3}	1
3	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
4	{18, 19, 12, 1, 3}	1
5	{18, 19, 12, 1, 23, 2, 3}	1
6	{18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
7	{18, 17, 15, 23, 2, 3}	-1
8	{18, 17, 15, 23, 7, 8, 1, 3}	1
9	{18, 17, 15, 23, 7, 8, 2, 3}	1
10	{18, 17, 15, 13, 10, 11, 12, 1, 3}	-1
11	{18, 17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	-1
12	{18, 17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
13	{18, 17, 15, 23, 19, 12, 1, 3}	-1
14	{18, 16, 13, 10, 11, 12, 17, 15, 23, 2, 3}	1
15	{18, 16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
16	{18, 16, 13, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
17	{18, 19, 12, 17, 15, 23, 2, 3}	1
18	{18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
19	{18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
20	{18, 19, 24, 23, 2, 3}	1
21	{18, 19, 24, 23, 7, 8, 1, 3}	-1
22	{18, 19, 24, 23, 7, 8, 2, 3}	-1
23	{18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
24	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
25	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
26	{18, 17, 15, 24, 23, 2, 3}	-1
27	{18, 17, 15, 24, 23, 7, 8, 1, 3}	1
28	{18, 17, 15, 24, 23, 7, 8, 2, 3}	1
29	{18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
30	{18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 18 to element 3

#	Path	Direction
31	{18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
32	{18, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
33	{18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 2, 3}	1
34	{18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
35	{18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
36	{18, 19, 12, 17, 15, 24, 23, 2, 3}	1
37	{18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
38	{18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
39	{18, 17, 15, 25, 26, 19, 12, 1, 3}	-1
40	{18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	-1
41	{18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
42	{18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
43	{18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
44	{18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
45	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
46	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
47	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
48	{18, 17, 15, 25, 26, 28, 3}	-1
49	{18, 17, 15, 25, 26, 28, 23, 2, 3}	1
50	{18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
51	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
52	{18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
53	{18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
54	{18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
55	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
56	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
57	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
58	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	-1
59	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	-1
60	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
61	{18, 17, 15, 25, 26, 28, 19, 12, 1, 3}	-1

Appendix 4_Paths of the system_From element 18 to element 3

#	Path	Direction
62	{18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
63	{18, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
64	{18, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	1
65	{18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	1
66	{18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
67	{18, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
68	{18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	1
69	{18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
70	{18, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
71	{18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
72	{18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
73	{18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
74	{18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
75	{18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
76	{18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
77	{18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
78	{18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
79	{18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
80	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	1
81	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
82	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
83	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3}	1
84	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
85	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
86	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
87	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
88	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
89	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
90	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
91	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
92	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 18 to element 3

#	Path	Direction
93	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
94	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
95	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
96	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
97	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
98	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
99	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
100	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
101	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
102	{18, 19, 12, 17, 15, 25, 26, 28, 3}	1
103	{18, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
104	{18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
105	{18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
106	{18, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
107	{18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
108	{18, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
109	{18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
110	{18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
111	{18, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 18 to element 19

#	Path	Direction
1	{18, 19}	1
2	{18, 16, 13, 10, 11, 12, 19}	-1
3	{18, 16, 13, 10, 11, 12, 1, 23, 19}	1
4	{18, 17, 15, 23, 19}	-1
5	{18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
6	{18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
7	{18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
8	{18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
9	{18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
10	{18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
11	{18, 17, 15, 13, 10, 11, 12, 19}	1
12	{18, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
13	{18, 17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	1
14	{18, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
15	{18, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
16	{18, 16, 13, 10, 11, 12, 17, 15, 23, 19}	1
17	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
18	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
19	{18, 17, 15, 24, 23, 19}	-1
20	{18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
21	{18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
22	{18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
23	{18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
24	{18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
25	{18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
26	{18, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	1
27	{18, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
28	{18, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
29	{18, 16, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
30	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 18 to element 19

#	Path	Direction
31	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
32	{18, 17, 15, 25, 26, 19}	-1
33	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
34	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
35	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
36	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
37	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
38	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
39	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
40	{18, 17, 15, 25, 26, 28, 19}	-1
41	{18, 17, 15, 25, 26, 28, 23, 19}	1
42	{18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
43	{18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
44	{18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
45	{18, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
46	{18, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
47	{18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
48	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
49	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
50	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
51	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
52	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
53	{18, 17, 15, 25, 26, 28, 27, 19}	1
54	{18, 17, 15, 25, 26, 28, 9, 27, 19}	1
55	{18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 19}	1
56	{18, 17, 15, 25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
57	{18, 17, 15, 25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
58	{18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 19}	1
59	{18, 17, 15, 25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
60	{18, 17, 15, 25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
61	{18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 18 to element 19

#	Path	Direction
62	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
63	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
64	{18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
65	{18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
66	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
67	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
68	{18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
69	{18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
70	{18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
71	{18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
72	{18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
73	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
74	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
75	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
76	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
77	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
78	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
79	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
80	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
81	{18, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	1
82	{18, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	-1
83	{18, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	-1
84	{18, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
85	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
86	{18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
87	{18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
88	{18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
89	{18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
90	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
91	{18, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
92	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 18 to element 19

#	Path	Direction
93	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
94	{18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
95	{18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
96	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
97	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
98	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
99	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
100	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
101	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
102	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
103	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
104	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
105	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
106	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
107	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
108	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
109	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
110	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
111	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
112	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
113	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
114	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
115	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
116	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
117	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
118	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
119	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
120	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
121	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
122	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
123	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 18 to element 19

#	Path	Direction
124	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
125	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
126	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
127	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
128	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
129	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
130	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 18 to element 27

#	Path	Direction
1	{18, 17, 15, 25, 26, 28, 27}	1
2	{18, 17, 15, 25, 26, 28, 9, 27}	1
3	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
4	{18, 16, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
5	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{18, 16, 13, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
8	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{18, 16, 13, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{18, 16, 13, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
14	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
16	{18, 16, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
17	{18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
18	{18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
20	{18, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
21	{18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
22	{18, 19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
23	{18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
24	{18, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
25	{18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
26	{18, 19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
27	{18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
28	{18, 19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
29	{18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
30	{18, 19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 18 to element 27

#	Path	Direction
31	{18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
32	{18, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
33	{18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
34	{18, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
35	{18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
36	{18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
37	{18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
38	{18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
39	{18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
40	{18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
41	{18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
42	{18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
43	{18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
44	{18, 19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
46	{18, 19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
47	{18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
48	{18, 19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
50	{18, 19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
51	{18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
52	{18, 19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
53	{18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
54	{18, 19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
55	{18, 19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
56	{18, 19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
57	{18, 19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
58	{18, 19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
59	{18, 19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
60	{18, 19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
61	{18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 18 to element 27

#	Path	Direction
62	{18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
63	{18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
64	{18, 16, 13, 10, 11, 12, 19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
65	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
66	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
67	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
68	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
69	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
70	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
71	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
72	{18, 16, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 19 to element 3

#	Path	Direction
1	{19, 12, 1, 3}	1
2	{19, 12, 1, 23, 2, 3}	1
3	{19, 12, 1, 23, 7, 8, 2, 3}	-1
4	{19, 12, 17, 15, 23, 2, 3}	1
5	{19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
6	{19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
7	{19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
8	{19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{19, 24, 23, 2, 3}	1
14	{19, 24, 23, 7, 8, 1, 3}	-1
15	{19, 24, 23, 7, 8, 2, 3}	-1
16	{19, 12, 17, 15, 24, 23, 2, 3}	1
17	{19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
18	{19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
19	{19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
20	{19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
21	{19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
22	{19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
23	{19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
24	{19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
25	{19, 12, 17, 15, 25, 26, 28, 3}	1
26	{19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
27	{19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
28	{19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
29	{19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
30	{19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 19 to element 3

#	Path	Direction
31	{19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
32	{19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
33	{19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
34	{19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
35	{19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
36	{19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
37	{19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
38	{19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
39	{19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
40	{19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
41	{19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
42	{19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
43	{19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
44	{19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
45	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
46	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
47	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
48	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
49	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
50	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
51	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
52	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
53	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
54	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 19 to element 27

#	Path	Direction
1	{19, 12, 17, 15, 25, 26, 28, 27}	-1
2	{19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
3	{19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
4	{19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{19, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{19, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
12	{19, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
14	{19, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
16	{19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
17	{19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
18	{19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
19	{19, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
20	{19, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
21	{19, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
22	{19, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
23	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
24	{19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
25	{19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
26	{19, 24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
27	{19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
28	{19, 24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
29	{19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
30	{19, 24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 19 to element 27

#	Path	Direction
31	{19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
32	{19, 24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
33	{19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
34	{19, 24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
35	{19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
36	{19, 24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
37	{19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
38	{19, 24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
39	{19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
40	{19, 24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
41	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
42	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
43	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
44	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
45	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
46	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
47	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
48	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
50	{19, 24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
51	{19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
52	{19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
53	{19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
54	{19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
55	{19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
56	{19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
57	{19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{19, 24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 19 to element 27

#	Path	Direction
62	{19, 24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
63	{19, 24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
64	{19, 24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
65	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
67	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
72	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
73	{19, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{19, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{19, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
78	{19, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
79	{19, 24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
80	{19, 24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
81	{19, 24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
82	{19, 24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
83	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
84	{19, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
85	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
86	{19, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
87	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
88	{19, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
89	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
90	{19, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
1	{20, 21, 1, 3}	-1
2	{20, 21, 2, 3}	1
3	{20, 21, 1, 23, 2, 3}	-1
4	{20, 5, 6, 8, 1, 3}	1
5	{20, 5, 6, 8, 2, 3}	1
6	{20, 5, 6, 8, 1, 23, 2, 3}	1
7	{20, 21, 1, 23, 7, 8, 2, 3}	1
8	{20, 5, 11, 12, 1, 3}	1
9	{20, 5, 11, 12, 1, 23, 2, 3}	1
10	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3}	-1
11	{20, 5, 17, 15, 23, 2, 3}	1
12	{20, 5, 17, 15, 23, 7, 8, 1, 3}	-1
13	{20, 5, 17, 15, 23, 7, 8, 2, 3}	-1
14	{20, 5, 17, 15, 13, 10, 11, 12, 1, 3}	1
15	{20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	1
16	{20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
17	{20, 5, 17, 15, 23, 19, 12, 1, 3}	1
18	{20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 3}	-1
19	{20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
20	{20, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
21	{20, 5, 11, 12, 17, 15, 23, 2, 3}	1
22	{20, 5, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
23	{20, 5, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
24	{20, 5, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
25	{20, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
26	{20, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
27	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
28	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
29	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
30	{20, 5, 11, 12, 19, 24, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
31	{20, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
32	{20, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
33	{20, 5, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
34	{20, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
35	{20, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
36	{20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
37	{20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
38	{20, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
39	{20, 5, 17, 15, 24, 23, 2, 3}	1
40	{20, 5, 17, 15, 24, 23, 7, 8, 1, 3}	-1
41	{20, 5, 17, 15, 24, 23, 7, 8, 2, 3}	-1
42	{20, 5, 17, 15, 24, 23, 19, 12, 1, 3}	1
43	{20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
44	{20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
45	{20, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
46	{20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
47	{20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
48	{20, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
49	{20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
50	{20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
51	{20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
52	{20, 5, 11, 12, 17, 15, 24, 23, 2, 3}	1
53	{20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
54	{20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
55	{20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
56	{20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
57	{20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
58	{20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
59	{20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
60	{20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
61	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
62	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
63	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
64	{20, 5, 17, 15, 25, 26, 19, 12, 1, 3}	1
65	{20, 5, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1
66	{20, 5, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
67	{20, 5, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
68	{20, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
69	{20, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
70	{20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
71	{20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
72	{20, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
73	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
74	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
75	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
76	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
77	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
78	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
79	{20, 5, 17, 15, 25, 26, 28, 3}	1
80	{20, 5, 17, 15, 25, 26, 28, 23, 2, 3}	-1
81	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
82	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
83	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
84	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
85	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
86	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
87	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
88	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
89	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	1
90	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	1
91	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
92	{20, 5, 17, 15, 25, 26, 28, 19, 12, 1, 3}	1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
93	{20, 5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	1
94	{20, 5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
95	{20, 5, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	-1
96	{20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	-1
97	{20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
98	{20, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
99	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	-1
100	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
101	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
102	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
103	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
104	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
105	{20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
106	{20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
107	{20, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
108	{20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
109	{20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
110	{20, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
111	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
112	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
113	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
114	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
115	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
116	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
117	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
118	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
119	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
120	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
121	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
122	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
123	{20, 5, 11, 12, 17, 15, 25, 26, 28, 3}	1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
124	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
125	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
126	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
127	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
128	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
129	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
130	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
131	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
132	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
133	{20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
134	{20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
135	{20, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
136	{20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
137	{20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
138	{20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
139	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
140	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
141	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
142	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
143	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
144	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
145	{20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
146	{20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
147	{20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
148	{20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
149	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
150	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
151	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
152	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
153	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
154	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
155	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
156	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
157	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
158	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
159	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
160	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
161	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
162	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
163	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
164	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
165	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
166	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
167	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
168	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
169	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
170	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
171	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
172	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
173	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
174	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
175	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
176	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
177	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
178	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
179	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
180	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
181	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
182	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
183	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
184	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
185	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 20 to element 3

#	Path	Direction
186	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
187	{20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
188	{20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
189	{20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
190	{20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1
191	{20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
192	{20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
193	{20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
194	{20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
1	{20, 21, 1, 23, 19}	-1
2	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19}	-1
3	{20, 5, 6, 8, 1, 23, 19}	1
4	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19}	1
5	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19}	1
6	{20, 5, 11, 12, 19}	-1
7	{20, 5, 11, 12, 1, 23, 19}	1
8	{20, 21, 1, 3, 22, 5, 11, 12, 19}	1
9	{20, 21, 2, 3, 22, 5, 11, 12, 19}	-1
10	{20, 21, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
11	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
12	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
13	{20, 21, 1, 3, 13, 10, 11, 12, 19}	1
14	{20, 21, 2, 3, 13, 10, 11, 12, 19}	-1
15	{20, 21, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
16	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
17	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 19}	-1
18	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 19}	-1
19	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
20	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
21	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
22	{20, 21, 1, 3, 13, 10, 14, 18, 19}	1
23	{20, 21, 2, 3, 13, 10, 14, 18, 19}	-1
24	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
25	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19}	-1
26	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19}	-1
27	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
28	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
29	{20, 5, 11, 12, 14, 18, 19}	1
30	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
31	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
32	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
33	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
34	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
35	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
36	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
37	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
38	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
39	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
40	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
41	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
42	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
43	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
44	{20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
45	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
46	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
47	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
48	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
49	{20, 5, 17, 15, 23, 19}	1
50	{20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
51	{20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
52	{20, 5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	-1
53	{20, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
54	{20, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
55	{20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
56	{20, 5, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
57	{20, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
58	{20, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
59	{20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
60	{20, 5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
61	{20, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
62	{20, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
63	{20, 21, 1, 3, 22, 5, 17, 15, 23, 19}	-1
64	{20, 21, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
65	{20, 21, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
66	{20, 21, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
67	{20, 21, 2, 3, 22, 5, 17, 15, 23, 19}	1
68	{20, 21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
69	{20, 21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
70	{20, 21, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
71	{20, 21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
72	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
73	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
74	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
75	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
76	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
77	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
78	{20, 5, 11, 12, 17, 15, 23, 19}	1
79	{20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
80	{20, 5, 11, 12, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
81	{20, 5, 11, 12, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
82	{20, 5, 11, 12, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
83	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
84	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
85	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
86	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
87	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
88	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
89	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
90	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
91	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
92	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
93	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
94	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
95	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
96	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
97	{20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
98	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
99	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
100	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
101	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
102	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
103	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
104	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
105	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
106	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
107	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
108	{20, 5, 17, 15, 24, 23, 19}	1
109	{20, 5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	-1
110	{20, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
111	{20, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
112	{20, 5, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
113	{20, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
114	{20, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
115	{20, 5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
116	{20, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
117	{20, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
118	{20, 21, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
119	{20, 21, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
120	{20, 5, 11, 12, 17, 15, 24, 23, 19}	1
121	{20, 5, 11, 12, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
122	{20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
123	{20, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
124	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
125	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
126	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
127	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
128	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
129	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
130	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
131	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
132	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
133	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
134	{20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
135	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
136	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
137	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
138	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
139	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
140	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
141	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
142	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
143	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
144	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
145	{20, 5, 17, 15, 25, 26, 19}	1
146	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
147	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
148	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
149	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
150	{20, 5, 11, 12, 17, 15, 25, 26, 19}	1
151	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
152	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
153	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
154	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
155	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
156	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
157	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
158	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
159	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
160	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
161	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
162	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
163	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
164	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
165	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
166	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
167	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
168	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
169	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
170	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
171	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
172	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
173	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
174	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
175	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
176	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
177	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
178	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
179	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
180	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
181	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
182	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
183	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
184	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
185	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
186	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
187	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
188	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
189	{20, 5, 17, 15, 25, 26, 28, 19}	1
190	{20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
191	{20, 5, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
192	{20, 5, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
193	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
194	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
195	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
196	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
197	{20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
198	{20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
199	{20, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	-1
200	{20, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	1
201	{20, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	1
202	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
203	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
204	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
205	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
206	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
207	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
208	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
209	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
210	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
211	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
212	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
213	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
214	{20, 5, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
215	{20, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
216	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
217	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
218	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
219	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
220	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
221	{20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
222	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
223	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
224	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
225	{20, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	1
226	{20, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
227	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
228	{20, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
229	{20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
230	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
231	{20, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
232	{20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
233	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
234	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
235	{20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
236	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
237	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
238	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
239	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
240	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
241	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
242	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
243	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
244	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
245	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
246	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
247	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
248	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
249	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
250	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
251	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
252	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
253	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
254	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
255	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
256	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
257	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
258	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
259	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
260	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
261	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
262	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
263	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
264	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
265	{20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
266	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
267	{20, 5, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
268	{20, 5, 11, 12, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
269	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
270	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
271	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
272	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
273	{20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
274	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
275	{20, 5, 11, 12, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
276	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
277	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
278	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
279	{20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
280	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
281	{20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
282	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
283	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
284	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
285	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
286	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
287	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
288	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
289	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
290	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
291	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
292	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
293	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
294	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
295	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
296	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
297	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
298	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
299	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
300	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
301	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
302	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
303	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
304	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
305	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
306	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
307	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
308	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
309	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
310	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
311	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
312	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
313	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
314	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
315	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
316	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
317	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
318	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
319	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
320	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
321	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
322	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
323	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
324	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
325	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
326	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
327	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
328	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
329	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
330	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
331	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
332	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
333	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
334	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
335	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
336	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
337	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
338	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
339	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
340	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
341	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
342	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
343	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
344	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
345	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
346	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
347	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
348	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
349	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
350	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
351	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
352	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
353	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
354	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
355	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
356	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
357	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
358	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
359	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
360	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
361	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
362	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
363	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
364	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
365	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
366	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
367	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
368	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
369	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
370	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
371	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
372	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
373	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
374	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
375	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
376	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
377	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
378	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
379	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
380	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
381	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
382	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
383	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
384	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
385	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
386	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
387	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
388	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
389	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
390	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
391	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
392	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
393	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
394	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
395	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
396	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
397	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
398	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
399	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
400	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
401	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
402	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
403	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
404	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
405	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
406	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
407	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
408	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
409	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
410	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
411	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
412	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
413	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
414	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
415	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
416	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
417	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
418	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
419	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
420	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
421	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
422	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
423	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
424	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
425	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
426	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
427	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
428	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
429	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
430	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
431	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
432	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
433	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 20 to element 19

#	Path	Direction
434	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
435	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
436	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
437	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
438	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
439	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
440	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
441	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
442	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
443	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
444	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
445	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
446	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
447	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
448	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 20 to element 27

#	Path	Direction
1	{20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
4	{20, 21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
6	{20, 21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
8	{20, 21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
12	{20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
13	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{20, 21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
16	{20, 21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
18	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
20	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{20, 21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{20, 21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
26	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
27	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
30	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 20 to element 27

#	Path	Direction
31	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
32	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
33	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
34	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
35	{20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
36	{20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
37	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
38	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
39	{20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
40	{20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
41	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
42	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
43	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
44	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{20, 21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{20, 21, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
48	{20, 21, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
49	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{20, 21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
51	{20, 21, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
52	{20, 21, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
53	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
55	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
56	{20, 21, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
57	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
59	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
60	{20, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
61	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 20 to element 27

#	Path	Direction
62	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
64	{20, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
65	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
67	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
68	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
69	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
72	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
73	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{20, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
78	{20, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
79	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
80	{20, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
81	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
82	{20, 21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
83	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
84	{20, 21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
85	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
86	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
87	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
88	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
89	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
90	{20, 21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
91	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
92	{20, 21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 20 to element 27

#	Path	Direction
93	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
94	{20, 21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
95	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
96	{20, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
97	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
98	{20, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
99	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
100	{20, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
101	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
102	{20, 21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
103	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
104	{20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
105	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
106	{20, 21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
107	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
108	{20, 21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
109	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
110	{20, 21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
111	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
112	{20, 21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
113	{20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
114	{20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
115	{20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
116	{20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
117	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
118	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
119	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
120	{20, 21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
121	{20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
122	{20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
123	{20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 20 to element 27

#	Path	Direction
124	{20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
125	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
126	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
127	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
128	{20, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
129	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
130	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
131	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
132	{20, 21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
133	{20, 5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
134	{20, 5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
135	{20, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
136	{20, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
137	{20, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
138	{20, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 21 to element 3

#	Path	Direction
1	{21, 1, 3}	1
2	{21, 2, 3}	-1
3	{21, 1, 23, 2, 3}	1
4	{21, 1, 23, 7, 8, 2, 3}	-1
5	{21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
6	{21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
7	{21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
8	{21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
9	{21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
10	{21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
11	{21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
12	{21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
13	{21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
1	{21, 1, 23, 19}	1
2	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19}	1
3	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19}	-1
4	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19}	-1
5	{21, 1, 3, 20, 5, 11, 12, 19}	-1
6	{21, 2, 3, 20, 5, 11, 12, 19}	1
7	{21, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
8	{21, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
9	{21, 1, 3, 22, 5, 11, 12, 19}	-1
10	{21, 2, 3, 22, 5, 11, 12, 19}	1
11	{21, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
12	{21, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
13	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
14	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
15	{21, 1, 3, 13, 10, 11, 12, 19}	-1
16	{21, 2, 3, 13, 10, 11, 12, 19}	1
17	{21, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
18	{21, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
19	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
20	{21, 1, 3, 13, 10, 14, 18, 19}	-1
21	{21, 2, 3, 13, 10, 14, 18, 19}	1
22	{21, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
23	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
24	{21, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
25	{21, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
26	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
27	{21, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
28	{21, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
29	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
30	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
31	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
32	{21, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
33	{21, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
34	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
35	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
36	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
37	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
38	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
39	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
40	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
41	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
42	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
43	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
44	{21, 1, 3, 20, 5, 17, 15, 23, 19}	1
45	{21, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
46	{21, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
47	{21, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
48	{21, 2, 3, 20, 5, 17, 15, 23, 19}	-1
49	{21, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
50	{21, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
51	{21, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
52	{21, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
53	{21, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
54	{21, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
55	{21, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
56	{21, 1, 3, 22, 5, 17, 15, 23, 19}	1
57	{21, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
58	{21, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
59	{21, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
60	{21, 2, 3, 22, 5, 17, 15, 23, 19}	-1
61	{21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
62	{21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
63	{21, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
64	{21, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
65	{21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
66	{21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
67	{21, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
68	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
69	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
70	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
71	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
72	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
73	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
74	{21, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
75	{21, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
76	{21, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
77	{21, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
78	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
79	{21, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
80	{21, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
81	{21, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
82	{21, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
83	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
84	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
85	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
86	{21, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
87	{21, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
88	{21, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
89	{21, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
90	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
91	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
92	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
93	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
94	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
95	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
96	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
97	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
98	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
99	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
100	{21, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
101	{21, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
102	{21, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
103	{21, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
104	{21, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
105	{21, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
106	{21, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
107	{21, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
108	{21, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
109	{21, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
110	{21, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
111	{21, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
112	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
113	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
114	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
115	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
116	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
117	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
118	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
119	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
120	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
121	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
122	{21, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
123	{21, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
124	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
125	{21, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
126	{21, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
127	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
128	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
129	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
130	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
131	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
132	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
133	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
134	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
135	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
136	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
137	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
138	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
139	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
140	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
141	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
142	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
143	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
144	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
145	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
146	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
147	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
148	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
149	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
150	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
151	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
152	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
153	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
154	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
155	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
156	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
157	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
158	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
159	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
160	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
161	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
162	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
163	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
164	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
165	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
166	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
167	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	-1
168	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
169	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
170	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
171	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
172	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
173	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
174	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
175	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
176	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
177	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
178	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
179	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
180	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
181	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
182	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
183	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
184	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
185	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
186	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
187	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
188	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
189	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
190	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
191	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
192	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
193	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
194	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
195	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
196	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
197	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 23, 19}	1
198	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
199	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
200	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
201	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
202	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
203	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
204	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
205	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
206	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
207	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
208	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
209	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
210	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
211	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
212	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
213	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
214	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
215	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
216	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
217	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
218	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
219	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
220	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
221	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
222	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
223	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
224	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
225	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
226	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
227	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
228	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
229	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
230	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
231	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
232	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
233	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
234	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
235	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
236	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
237	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
238	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
239	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
240	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
241	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
242	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
243	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
244	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
245	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
246	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
247	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
248	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
249	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
250	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
251	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
252	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
253	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
254	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
255	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
256	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
257	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
258	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
259	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
260	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
261	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
262	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
263	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
264	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
265	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
266	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
267	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
268	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
269	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
270	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
271	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
272	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
273	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
274	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
275	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
276	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
277	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
278	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
279	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
280	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
281	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
282	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
283	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
284	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
285	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
286	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
287	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
288	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
289	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
290	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
291	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
292	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
293	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
294	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
295	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
296	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
297	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
298	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
299	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
300	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
301	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
302	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
303	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
304	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
305	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
306	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
307	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
308	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
309	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
310	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
311	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
312	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
313	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
314	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
315	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
316	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
317	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
318	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
319	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
320	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
321	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
322	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
323	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
324	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
325	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
326	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
327	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
328	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
329	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
330	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
331	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
332	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
333	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
334	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
335	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
336	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
337	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
338	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
339	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
340	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
341	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
342	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
343	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
344	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
345	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
346	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
347	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
348	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
349	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
350	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
351	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
352	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
353	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
354	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
355	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
356	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
357	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
358	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
359	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
360	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
361	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
362	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
363	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
364	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
365	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
366	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
367	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
368	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
369	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
370	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
371	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 19

#	Path	Direction
372	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
373	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
374	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
375	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 21 to element 27

#	Path	Direction
1	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{21, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{21, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{21, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
8	{21, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{21, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{21, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
14	{21, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
15	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
16	{21, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
17	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
18	{21, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
20	{21, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
22	{21, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
23	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{21, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
26	{21, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
27	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{21, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
30	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 21 to element 27

#	Path	Direction
31	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
32	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
33	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
34	{21, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
35	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
36	{21, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
37	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
38	{21, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
39	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
40	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
41	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{21, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
44	{21, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
45	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{21, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
48	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
49	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{21, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{21, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{21, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
55	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{21, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{21, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
59	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{21, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 21 to element 27

#	Path	Direction
62	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
64	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
65	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
66	{21, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
67	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{21, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
70	{21, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
71	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
72	{21, 1, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
73	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{21, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{21, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
78	{21, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
79	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
80	{21, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
81	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
82	{21, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
83	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
84	{21, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
85	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
86	{21, 1, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
87	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
88	{21, 1, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
89	{21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
90	{21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
91	{21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
92	{21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 21 to element 27

#	Path	Direction
93	{21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
94	{21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
95	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
96	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
97	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
98	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
99	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
100	{21, 2, 3, 22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
101	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
102	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
103	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
104	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
105	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
106	{21, 2, 3, 20, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
107	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
108	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
109	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
110	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
111	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
112	{21, 2, 3, 22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
113	{21, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
114	{21, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
115	{21, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
116	{21, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
117	{21, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
118	{21, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
119	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
120	{21, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
1	{22, 4, 6, 8, 1, 3}	-1
2	{22, 4, 6, 8, 2, 3}	-1
3	{22, 4, 6, 8, 1, 23, 2, 3}	-1
4	{22, 5, 6, 8, 1, 3}	1
5	{22, 5, 6, 8, 2, 3}	1
6	{22, 5, 6, 8, 1, 23, 2, 3}	1
7	{22, 5, 11, 12, 1, 3}	1
8	{22, 5, 11, 12, 1, 23, 2, 3}	1
9	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3}	-1
10	{22, 5, 17, 15, 23, 2, 3}	1
11	{22, 5, 17, 15, 23, 7, 8, 1, 3}	-1
12	{22, 5, 17, 15, 23, 7, 8, 2, 3}	-1
13	{22, 5, 17, 15, 13, 10, 11, 12, 1, 3}	1
14	{22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 2, 3}	1
15	{22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
16	{22, 5, 17, 15, 23, 19, 12, 1, 3}	1
17	{22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 3}	-1
18	{22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
19	{22, 5, 17, 15, 13, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
20	{22, 5, 11, 12, 17, 15, 23, 2, 3}	1
21	{22, 5, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
22	{22, 5, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
23	{22, 5, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
24	{22, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
25	{22, 5, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
26	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
27	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
28	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
29	{22, 5, 11, 12, 19, 24, 23, 2, 3}	-1
30	{22, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
31	{22, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
32	{22, 5, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
33	{22, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
34	{22, 5, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
35	{22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 2, 3}	1
36	{22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
37	{22, 5, 11, 12, 16, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
38	{22, 5, 17, 15, 24, 23, 2, 3}	1
39	{22, 5, 17, 15, 24, 23, 7, 8, 1, 3}	-1
40	{22, 5, 17, 15, 24, 23, 7, 8, 2, 3}	-1
41	{22, 5, 17, 15, 24, 23, 19, 12, 1, 3}	1
42	{22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 2, 3}	-1
43	{22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
44	{22, 5, 17, 15, 13, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
45	{22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
46	{22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
47	{22, 5, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
48	{22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
49	{22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
50	{22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
51	{22, 5, 11, 12, 17, 15, 24, 23, 2, 3}	1
52	{22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
53	{22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
54	{22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 2, 3}	-1
55	{22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
56	{22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
57	{22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
58	{22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
59	{22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
60	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
61	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
62	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
63	{22, 5, 17, 15, 25, 26, 19, 12, 1, 3}	1
64	{22, 5, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1
65	{22, 5, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
66	{22, 5, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
67	{22, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
68	{22, 5, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
69	{22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
70	{22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
71	{22, 5, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
72	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
73	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
74	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
75	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
76	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
77	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1
78	{22, 5, 17, 15, 25, 26, 28, 3}	1
79	{22, 5, 17, 15, 25, 26, 28, 23, 2, 3}	-1
80	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
81	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
82	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
83	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
84	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
85	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
86	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
87	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
88	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 3}	1
89	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	1
90	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
91	{22, 5, 17, 15, 25, 26, 28, 19, 12, 1, 3}	1
92	{22, 5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
93	{22, 5, 17, 15, 25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
94	{22, 5, 17, 15, 25, 26, 28, 23, 19, 12, 1, 3}	-1
95	{22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 3}	-1
96	{22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
97	{22, 5, 17, 15, 25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
98	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 3}	-1
99	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
100	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
101	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
102	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
103	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
104	{22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
105	{22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
106	{22, 5, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
107	{22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
108	{22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
109	{22, 5, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
110	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
111	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
112	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
113	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
114	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
115	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
116	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
117	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
118	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
119	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
120	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
121	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
122	{22, 5, 11, 12, 17, 15, 25, 26, 28, 3}	1
123	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
124	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
125	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
126	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
127	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1
128	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
129	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
130	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
131	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
132	{22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	1
133	{22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	-1
134	{22, 5, 11, 12, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
135	{22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	-1
136	{22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
137	{22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
138	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
139	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
140	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
141	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
142	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
143	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
144	{22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
145	{22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
146	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
147	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
148	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
149	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
150	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
151	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
152	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
153	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
154	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
155	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
156	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
157	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
158	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
159	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
160	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
161	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
162	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
163	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
164	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
165	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
166	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
167	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
168	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
169	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
170	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
171	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
172	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
173	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
174	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
175	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 2, 3}	-1
176	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1
177	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
178	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 2, 3}	1
179	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
180	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
181	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
182	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
183	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
184	{22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
185	{22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1

Appendix 4_Paths of the system_From element 22 to element 3

#	Path	Direction
186	{22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
187	{22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
1	{22, 4, 6, 8, 1, 23, 19}	-1
2	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19}	-1
3	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19}	1
4	{22, 5, 6, 8, 1, 23, 19}	1
5	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19}	1
6	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19}	-1
7	{22, 5, 11, 12, 19}	-1
8	{22, 5, 11, 12, 1, 23, 19}	1
9	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 19}	1
10	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 19}	1
11	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
12	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
13	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 19}	1
14	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 19}	1
15	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
16	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
17	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 19}	-1
18	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 19}	-1
19	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
20	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
21	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 19}	1
22	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 19}	1
23	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
24	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19}	-1
25	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19}	-1
26	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
27	{22, 5, 11, 12, 14, 18, 19}	1
28	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 19}	-1
29	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
30	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
31	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
32	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
33	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
34	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
35	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
36	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
37	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
38	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
39	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
40	{22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
41	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
42	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
43	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
44	{22, 5, 17, 15, 23, 19}	1
45	{22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
46	{22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
47	{22, 5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 19}	-1
48	{22, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
49	{22, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
50	{22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
51	{22, 5, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
52	{22, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
53	{22, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
54	{22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
55	{22, 5, 17, 15, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
56	{22, 5, 17, 15, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
57	{22, 5, 17, 15, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
58	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
59	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
60	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
61	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
62	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
63	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
64	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
65	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
66	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
67	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
68	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
69	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
70	{22, 5, 11, 12, 17, 15, 23, 19}	1
71	{22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
72	{22, 5, 11, 12, 17, 15, 23, 2, 3, 13, 10, 14, 18, 19}	-1
73	{22, 5, 11, 12, 17, 15, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
74	{22, 5, 11, 12, 17, 15, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
75	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
76	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
77	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
78	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
79	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
80	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
81	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
82	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
83	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
84	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
85	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
86	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
87	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
88	{22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
89	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
90	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
91	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
92	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
93	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
94	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
95	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
96	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
97	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
98	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
99	{22, 5, 17, 15, 24, 23, 19}	1
100	{22, 5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 19}	-1
101	{22, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
102	{22, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
103	{22, 5, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
104	{22, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
105	{22, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
106	{22, 5, 17, 15, 24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
107	{22, 5, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
108	{22, 5, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
109	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
110	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
111	{22, 5, 11, 12, 17, 15, 24, 23, 19}	1
112	{22, 5, 11, 12, 17, 15, 24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
113	{22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
114	{22, 5, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
115	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
116	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
117	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
118	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
119	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
120	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
121	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
122	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
123	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
124	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
125	{22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
126	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
127	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
128	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
129	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
130	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
131	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
132	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
133	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
134	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
135	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
136	{22, 5, 17, 15, 25, 26, 19}	1
137	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
138	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
139	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
140	{22, 5, 11, 12, 17, 15, 25, 26, 19}	1
141	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
142	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
143	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
144	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
145	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
146	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
147	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
148	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
149	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
150	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
151	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
152	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
153	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
154	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
155	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
156	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
157	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
158	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
159	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
160	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
161	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
162	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
163	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
164	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
165	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
166	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
167	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
168	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
169	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
170	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
171	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
172	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
173	{22, 5, 17, 15, 25, 26, 28, 19}	1
174	{22, 5, 17, 15, 25, 26, 28, 23, 19}	-1
175	{22, 5, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
176	{22, 5, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
177	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1
178	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
179	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
180	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
181	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
182	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
183	{22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
184	{22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
185	{22, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
186	{22, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	1
187	{22, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	1
188	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
189	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
190	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
191	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
192	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
193	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
194	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
195	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	1
196	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
197	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
198	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
199	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
200	{22, 5, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
201	{22, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
202	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
203	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
204	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
205	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
206	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
207	{22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
208	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
209	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
210	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
211	{22, 5, 17, 15, 25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	1
212	{22, 5, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
213	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
214	{22, 5, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
215	{22, 5, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
216	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
217	{22, 5, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
218	{22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
219	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
220	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
221	{22, 5, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
222	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
223	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
224	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
225	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
226	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
227	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
228	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
229	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
230	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 23, 19}	1
231	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
232	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
233	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
234	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
235	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
236	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
237	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
238	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
239	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
240	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
241	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
242	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
243	{22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
244	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
245	{22, 5, 11, 12, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	1
246	{22, 5, 11, 12, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	-1
247	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	-1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
248	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
249	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
250	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	1
251	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
252	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
253	{22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
254	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
255	{22, 5, 11, 12, 17, 15, 25, 26, 28, 3, 13, 10, 14, 18, 19}	-1
256	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
257	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
258	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
259	{22, 5, 11, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
260	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
261	{22, 5, 11, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
262	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
263	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
264	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
265	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
266	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
267	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
268	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
269	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
270	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
271	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
272	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
273	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
274	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
275	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
276	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
277	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
278	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
279	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
280	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
281	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
282	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
283	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
284	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
285	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	1
286	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
287	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
288	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
289	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
290	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
291	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
292	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
293	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
294	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
295	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
296	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 23, 19}	-1
297	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
298	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
299	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
300	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
301	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
302	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
303	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
304	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
305	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
306	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
307	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
308	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
309	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
310	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
311	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
312	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
313	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
314	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
315	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
316	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
317	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
318	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
319	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
320	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
321	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
322	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
323	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
324	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
325	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
326	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
327	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
328	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
329	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
330	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
331	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
332	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
333	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
334	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
335	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
336	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
337	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
338	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
339	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
340	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
341	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
342	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
343	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
344	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
345	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
346	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
347	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
348	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
349	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
350	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
351	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
352	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
353	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
354	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
355	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
356	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
357	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
358	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
359	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
360	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
361	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
362	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
363	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
364	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
365	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
366	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
367	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
368	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
369	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
370	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
371	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 22 to element 19

#	Path	Direction
372	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
373	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
374	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
375	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
376	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
377	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
378	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
379	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
380	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	1
381	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 21, 1, 23, 19}	-1
382	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3, 20, 21, 1, 23, 19}	1
383	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 19}	1
384	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
385	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
386	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
387	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
388	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
389	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
390	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
391	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
392	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
393	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
394	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
395	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
396	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 19}	-1
397	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
398	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
399	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
400	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
401	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 22 to element 27

#	Path	Direction
1	{22, 5, 17, 15, 25, 26, 28, 27}	-1
2	{22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
4	{22, 4, 6, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{22, 4, 6, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
8	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
10	{22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
11	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
12	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
13	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
16	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
18	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
20	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
26	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
27	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
30	{22, 4, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 22 to element 27

#	Path	Direction
31	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
32	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
33	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
34	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
35	{22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
36	{22, 5, 6, 8, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
37	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
38	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
39	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 27}	1
40	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
41	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
42	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
43	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
44	{22, 4, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
45	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
46	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
47	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
48	{22, 4, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
49	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
52	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
53	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
56	{22, 5, 6, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
57	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
58	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
59	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
60	{22, 5, 6, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
61	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 22 to element 27

#	Path	Direction
62	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
64	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
65	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
66	{22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
67	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{22, 5, 11, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{22, 5, 11, 12, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
72	{22, 5, 11, 12, 1, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
73	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
74	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
75	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
78	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
79	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
80	{22, 4, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
81	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
82	{22, 4, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
83	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
84	{22, 4, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
85	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
86	{22, 5, 6, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
87	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
88	{22, 5, 6, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
89	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
90	{22, 5, 6, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
91	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
92	{22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 22 to element 27

#	Path	Direction
93	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
94	{22, 4, 6, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
95	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
96	{22, 4, 6, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
97	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
98	{22, 4, 6, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
99	{22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
100	{22, 4, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
101	{22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
102	{22, 4, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
103	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
104	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
105	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
106	{22, 4, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
107	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
108	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
109	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
110	{22, 4, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
111	{22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
112	{22, 5, 6, 8, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
113	{22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
114	{22, 5, 6, 8, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
115	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
116	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
117	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
118	{22, 5, 6, 8, 2, 3, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
119	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
120	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
121	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
122	{22, 5, 6, 8, 2, 3, 20, 21, 1, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
123	{22, 5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1

Appendix 4_Paths of the system_From element 22 to element 27

#	Path	Direction
124	{22, 5, 11, 12, 19, 24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
125	{22, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
126	{22, 5, 11, 12, 19, 24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
127	{22, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
128	{22, 5, 11, 12, 19, 24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 23 to element 3

#	Path	Direction
1	{23, 2, 3}	-1
2	{23, 7, 8, 1, 3}	1
3	{23, 7, 8, 2, 3}	1
4	{23, 19, 12, 1, 3}	-1
5	{23, 19, 12, 17, 15, 25, 26, 28, 3}	-1
6	{23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
7	{23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
8	{23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
9	{23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
10	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	1
11	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
12	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
13	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
14	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
15	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	1
16	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
17	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
18	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
19	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
1	{23, 19}	-1
2	{23, 2, 3, 20, 5, 11, 12, 19}	1
3	{23, 2, 3, 22, 5, 11, 12, 19}	1
4	{23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
5	{23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
6	{23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
7	{23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
8	{23, 2, 3, 13, 10, 11, 12, 19}	1
9	{23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
10	{23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
11	{23, 2, 3, 13, 10, 14, 18, 19}	1
12	{23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
13	{23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
14	{23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
15	{23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
16	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
17	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
18	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
19	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
20	{23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
21	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
22	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
23	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
24	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
25	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
26	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
27	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
28	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
29	{23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
30	{23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
31	{23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
32	{23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
33	{23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
34	{23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
35	{23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
36	{23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
37	{23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
38	{23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
39	{23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
40	{23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
41	{23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
42	{23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
43	{23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
44	{23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
45	{23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
46	{23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
47	{23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
48	{23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
49	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
50	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
51	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
52	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
53	{23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
54	{23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
55	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
56	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
57	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
58	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
59	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
60	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
61	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
62	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
63	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
64	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
65	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
66	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
67	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
68	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
69	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
70	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
71	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
72	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
73	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
74	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
75	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
76	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
77	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
78	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
79	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
80	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
81	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
82	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
83	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
84	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
85	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
86	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
87	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
88	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
89	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
90	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
91	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
92	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
93	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
94	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
95	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
96	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
97	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
98	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
99	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
100	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
101	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
102	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
103	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
104	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
105	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
106	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
107	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
108	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
109	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
110	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
111	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
112	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
113	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
114	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
115	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
116	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1
117	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
118	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
119	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
120	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
121	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
122	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
123	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
124	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
125	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
126	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
127	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
128	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
129	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
130	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
131	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
132	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
133	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
134	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
135	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
136	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
137	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
138	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
139	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
140	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
141	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
142	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
143	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
144	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
145	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
146	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
147	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
148	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
149	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
150	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
151	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
152	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
153	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
154	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
155	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
156	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
157	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
158	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
159	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
160	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
161	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
162	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
163	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
164	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
165	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
166	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
167	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
168	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
169	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
170	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
171	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
172	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
173	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
174	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
175	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
176	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
177	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
178	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
179	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
180	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
181	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
182	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
183	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
184	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
185	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1

Appendix 4_Paths of the system_From element 23 to element 19

#	Path	Direction
186	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
187	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
188	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
189	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
190	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
191	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
192	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
193	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
194	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
195	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
196	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
197	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
198	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
199	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
200	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
201	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
202	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
203	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
204	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
205	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
206	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
207	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
208	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 23 to element 27

#	Path	Direction
1	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
2	{23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
3	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
4	{23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
5	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
6	{23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
7	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
8	{23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
9	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
10	{23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
11	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
12	{23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
13	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
14	{23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
15	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
16	{23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
17	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
18	{23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
19	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
20	{23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
21	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
22	{23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
23	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
24	{23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
25	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
26	{23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
27	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
28	{23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
29	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
30	{23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 23 to element 27

#	Path	Direction
31	{23, 19, 12, 17, 15, 25, 26, 28, 27}	1
32	{23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
33	{23, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
34	{23, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
35	{23, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
36	{23, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
37	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
40	{23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
41	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{23, 7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
44	{23, 7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
45	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
48	{23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
49	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
50	{23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
51	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
54	{23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
55	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
60	{23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
61	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 23 to element 27

#	Path	Direction
62	{23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
64	{23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
65	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
66	{23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
67	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
68	{23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
69	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
70	{23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
71	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
72	{23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
73	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
76	{23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
77	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
78	{23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
79	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
80	{23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
81	{23, 19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
82	{23, 19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
83	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
84	{23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 24 to element 3

#	Path	Direction
1	{24, 23, 2, 3}	1
2	{24, 23, 7, 8, 1, 3}	-1
3	{24, 23, 7, 8, 2, 3}	-1
4	{24, 23, 19, 12, 1, 3}	1
5	{24, 23, 19, 12, 17, 15, 25, 26, 28, 3}	1
6	{24, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
7	{24, 23, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
8	{24, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
9	{24, 23, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
10	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
11	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
12	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
13	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
14	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
15	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
16	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
17	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
18	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
19	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
1	{24, 23, 19}	1
2	{24, 23, 2, 3, 20, 5, 11, 12, 19}	-1
3	{24, 23, 2, 3, 22, 5, 11, 12, 19}	-1
4	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
5	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
6	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
7	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
8	{24, 23, 2, 3, 13, 10, 11, 12, 19}	-1
9	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
10	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
11	{24, 23, 2, 3, 13, 10, 14, 18, 19}	-1
12	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
13	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
14	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
15	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
16	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
17	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
18	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
19	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
20	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
21	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
22	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
23	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
24	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
25	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
26	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
27	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
28	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
29	{24, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
30	{24, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
31	{24, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
32	{24, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
33	{24, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
34	{24, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
35	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
36	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
37	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
38	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
39	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
40	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
41	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
42	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
43	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
44	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
45	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
46	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
47	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
48	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
49	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
50	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
51	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
52	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
53	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
54	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
55	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
56	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
57	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
58	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
59	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
60	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
61	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
62	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
63	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
64	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
65	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
66	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
67	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
68	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
69	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
70	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
71	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
72	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
73	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
74	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
75	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
76	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
77	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
78	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
79	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
80	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
81	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
82	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
83	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
84	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
85	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
86	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	1
87	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	-1
88	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
89	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
90	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
91	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
92	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
93	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	-1
94	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	-1
95	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	-1
96	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
97	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	1
98	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
99	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
100	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
101	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
102	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
103	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
104	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 19}	-1
105	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27, 19}	1
106	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
107	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
108	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
109	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
110	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
111	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
112	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
113	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
114	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
115	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
116	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 19}	-1
117	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27, 19}	1
118	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27, 19}	1
119	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 19}	1
120	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
121	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
122	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
123	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
124	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
125	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
126	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	1
127	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
128	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
129	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	-1
130	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
131	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
132	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
133	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
134	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
135	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
136	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
137	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
138	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
139	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
140	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
141	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
142	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 19}	-1
143	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
144	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
145	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 10, 14, 18, 19}	1
146	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	1
147	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	-1
148	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	-1
149	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
150	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
151	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1
152	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 19}	-1
153	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27, 19}	1
154	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27, 19}	1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
155	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
156	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
157	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
158	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
159	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
160	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
161	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
162	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
163	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
164	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
165	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
166	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
167	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
168	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
169	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
170	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
171	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
172	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
173	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
174	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
175	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
176	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
177	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
178	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
179	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
180	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
181	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
182	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	-1
183	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
184	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
185	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1

Appendix 4_Paths of the system_From element 24 to element 19

#	Path	Direction
186	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
187	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
188	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 19}	1
189	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
190	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
191	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
192	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
193	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
194	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	-1
195	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	1
196	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	1
197	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
198	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
199	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
200	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
201	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
202	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
203	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
204	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
205	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1
206	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 19}	1
207	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27, 19}	-1
208	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27, 19}	-1

Appendix 4_Paths of the system_From element 24 to element 27

#	Path	Direction
1	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
2	{24, 23, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
3	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
4	{24, 23, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
5	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
6	{24, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
7	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 27}	1
8	{24, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	1
9	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
10	{24, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
11	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 27}	1
12	{24, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	1
13	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
14	{24, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
15	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	-1
16	{24, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
17	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
18	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
19	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
20	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
21	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
22	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
23	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 27}	1
24	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
25	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	-1
26	{24, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	-1
27	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
28	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1
29	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 27}	1
30	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 24 to element 27

#	Path	Direction
31	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
32	{24, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
33	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
34	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
35	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
36	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
37	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
38	{24, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
39	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
40	{24, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
41	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
42	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
43	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
44	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
45	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
46	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
47	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
48	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
49	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
50	{24, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
51	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
52	{24, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
53	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 27}	-1
54	{24, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
55	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
56	{24, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
57	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
58	{24, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
59	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
60	{24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
61	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1

Appendix 4_Paths of the system_From element 24 to element 27

#	Path	Direction
62	{24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
63	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
64	{24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
65	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
66	{24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
67	{24, 23, 19, 12, 17, 15, 25, 26, 28, 27}	-1
68	{24, 23, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
69	{24, 23, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 27}	-1
70	{24, 23, 19, 12, 1, 3, 20, 5, 17, 15, 25, 26, 28, 9, 27}	-1
71	{24, 23, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 27}	-1
72	{24, 23, 19, 12, 1, 3, 22, 5, 17, 15, 25, 26, 28, 9, 27}	-1
73	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 27}	1
74	{24, 23, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
75	{24, 23, 19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	-1
76	{24, 23, 19, 12, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	-1
77	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 27}	1
78	{24, 23, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 27}	1
79	{24, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	1
80	{24, 23, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	1
81	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
82	{24, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1
83	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 27}	-1
84	{24, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19, 12, 17, 15, 25, 26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 25 to element 3

#	Path	Direction
1	{25, 26, 19, 12, 1, 3}	-1
2	{25, 26, 19, 12, 1, 23, 2, 3}	-1
3	{25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	1
4	{25, 26, 19, 12, 17, 15, 23, 2, 3}	-1
5	{25, 26, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
6	{25, 26, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
7	{25, 26, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1
8	{25, 26, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
9	{25, 26, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
10	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
11	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
12	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
13	{25, 26, 19, 24, 23, 2, 3}	-1
14	{25, 26, 19, 24, 23, 7, 8, 1, 3}	1
15	{25, 26, 19, 24, 23, 7, 8, 2, 3}	1
16	{25, 26, 19, 12, 17, 15, 24, 23, 2, 3}	-1
17	{25, 26, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
18	{25, 26, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
19	{25, 26, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
20	{25, 26, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
21	{25, 26, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
22	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
23	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
24	{25, 26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
25	{25, 26, 28, 3}	-1
26	{25, 26, 28, 23, 2, 3}	1
27	{25, 26, 28, 7, 8, 1, 3}	1
28	{25, 26, 28, 7, 8, 2, 3}	1
29	{25, 26, 28, 7, 8, 1, 23, 2, 3}	1
30	{25, 26, 28, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 25 to element 3

#	Path	Direction
31	{25, 26, 28, 23, 7, 8, 2, 3}	-1
32	{25, 26, 28, 9, 7, 8, 1, 3}	-1
33	{25, 26, 28, 9, 7, 8, 2, 3}	-1
34	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
35	{25, 26, 28, 9, 10, 11, 12, 1, 3}	-1
36	{25, 26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	-1
37	{25, 26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	1
38	{25, 26, 28, 19, 12, 1, 3}	-1
39	{25, 26, 28, 19, 12, 1, 23, 2, 3}	-1
40	{25, 26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	1
41	{25, 26, 28, 23, 19, 12, 1, 3}	1
42	{25, 26, 28, 27, 19, 12, 1, 3}	1
43	{25, 26, 28, 27, 19, 12, 1, 23, 2, 3}	1
44	{25, 26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
45	{25, 26, 28, 9, 27, 19, 12, 1, 3}	1
46	{25, 26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	1
47	{25, 26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
48	{25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	1
49	{25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	1
50	{25, 26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	-1
51	{25, 26, 28, 9, 10, 11, 12, 17, 15, 23, 2, 3}	-1
52	{25, 26, 28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	1
53	{25, 26, 28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	1
54	{25, 26, 28, 19, 12, 17, 15, 23, 2, 3}	-1
55	{25, 26, 28, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
56	{25, 26, 28, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
57	{25, 26, 28, 27, 19, 12, 17, 15, 23, 2, 3}	1
58	{25, 26, 28, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
59	{25, 26, 28, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
60	{25, 26, 28, 9, 27, 19, 12, 17, 15, 23, 2, 3}	1
61	{25, 26, 28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 25 to element 3

#	Path	Direction
62	{25, 26, 28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
63	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3}	-1
64	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
65	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
66	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	-1
67	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	1
68	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
69	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
70	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	1
71	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
72	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
73	{25, 26, 28, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1
74	{25, 26, 28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
75	{25, 26, 28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
76	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
77	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
78	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
79	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
80	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
81	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
82	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
83	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
84	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
85	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
86	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
87	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
88	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
89	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
90	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
91	{25, 26, 28, 19, 24, 23, 2, 3}	-1
92	{25, 26, 28, 19, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 25 to element 3

#	Path	Direction
93	{25, 26, 28, 19, 24, 23, 7, 8, 2, 3}	1
94	{25, 26, 28, 27, 19, 24, 23, 2, 3}	1
95	{25, 26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	-1
96	{25, 26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	-1
97	{25, 26, 28, 9, 27, 19, 24, 23, 2, 3}	1
98	{25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	-1
99	{25, 26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	-1
100	{25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	1
101	{25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	-1
102	{25, 26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	-1
103	{25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	1
104	{25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
105	{25, 26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
106	{25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	-1
107	{25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
108	{25, 26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
109	{25, 26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 2, 3}	-1
110	{25, 26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
111	{25, 26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
112	{25, 26, 28, 19, 12, 17, 15, 24, 23, 2, 3}	-1
113	{25, 26, 28, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
114	{25, 26, 28, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
115	{25, 26, 28, 27, 19, 12, 17, 15, 24, 23, 2, 3}	1
116	{25, 26, 28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
117	{25, 26, 28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
118	{25, 26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 2, 3}	1
119	{25, 26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
120	{25, 26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
121	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
122	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
123	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 25 to element 3

#	Path	Direction
124	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	-1
125	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	1
126	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
127	{25, 26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
128	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
129	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
130	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
131	{25, 26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
132	{25, 26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
133	{25, 26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
134	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
135	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
136	{25, 26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
137	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
138	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
139	{25, 26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
140	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
141	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
142	{25, 26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
143	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
144	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
145	{25, 26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
146	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
147	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
148	{25, 26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
1	{25, 26, 19}	-1
2	{25, 26, 28, 19}	-1
3	{25, 26, 28, 23, 19}	1
4	{25, 26, 28, 3, 21, 1, 23, 19}	-1
5	{25, 26, 28, 3, 20, 21, 1, 23, 19}	1
6	{25, 26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	1
7	{25, 26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	-1
8	{25, 26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	-1
9	{25, 26, 28, 7, 8, 1, 23, 19}	1
10	{25, 26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	1
11	{25, 26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
12	{25, 26, 28, 9, 7, 8, 1, 23, 19}	-1
13	{25, 26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	-1
14	{25, 26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
15	{25, 26, 28, 27, 19}	1
16	{25, 26, 28, 9, 27, 19}	1
17	{25, 26, 28, 3, 20, 5, 11, 12, 19}	1
18	{25, 26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	-1
19	{25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	-1
20	{25, 26, 28, 3, 22, 5, 11, 12, 19}	1
21	{25, 26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	-1
22	{25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	-1
23	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
24	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
25	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
26	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
27	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
28	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
29	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
30	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
31	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
32	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
33	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
34	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
35	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
36	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
37	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
38	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
39	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
40	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
41	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
42	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
43	{25, 26, 28, 3, 13, 10, 11, 12, 19}	1
44	{25, 26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	-1
45	{25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	-1
46	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
47	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
48	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
49	{25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
50	{25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
51	{25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
52	{25, 26, 28, 9, 10, 11, 12, 19}	1
53	{25, 26, 28, 9, 10, 11, 12, 1, 23, 19}	-1
54	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
55	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
56	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
57	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
58	{25, 26, 28, 3, 13, 10, 14, 18, 19}	1
59	{25, 26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	-1
60	{25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
61	{25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
62	{25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
63	{25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
64	{25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
65	{25, 26, 28, 9, 10, 14, 18, 19}	1
66	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
67	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
68	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
69	{25, 26, 28, 3, 20, 5, 11, 12, 14, 18, 19}	-1
70	{25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
71	{25, 26, 28, 3, 22, 5, 11, 12, 14, 18, 19}	-1
72	{25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
73	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
74	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
75	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
76	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
77	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
78	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
79	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
80	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
81	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
82	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
83	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
84	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
85	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
86	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
87	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
88	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
89	{25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	-1
90	{25, 26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
91	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
92	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
93	{25, 26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
94	{25, 26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
95	{25, 26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
96	{25, 26, 28, 9, 10, 11, 12, 14, 18, 19}	-1
97	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
98	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
99	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
100	{25, 26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
101	{25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
102	{25, 26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
103	{25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
104	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
105	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
106	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
107	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
108	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
109	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
110	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
111	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
112	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
113	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
114	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
115	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
116	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
117	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
118	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
119	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
120	{25, 26, 28, 3, 20, 5, 17, 15, 23, 19}	-1
121	{25, 26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
122	{25, 26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
123	{25, 26, 28, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
124	{25, 26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
125	{25, 26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
126	{25, 26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
127	{25, 26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
128	{25, 26, 28, 3, 22, 5, 17, 15, 23, 19}	-1
129	{25, 26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
130	{25, 26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
131	{25, 26, 28, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
132	{25, 26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
133	{25, 26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
134	{25, 26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
135	{25, 26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
136	{25, 26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	1
137	{25, 26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
138	{25, 26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
139	{25, 26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
140	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	1
141	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
142	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
143	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
144	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
145	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
146	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
147	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
148	{25, 26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	1
149	{25, 26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
150	{25, 26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
151	{25, 26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
152	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	1
153	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
154	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
155	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
156	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
157	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
158	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
159	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
160	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
161	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
162	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
163	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
164	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
165	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
166	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
167	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
168	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
169	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
170	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
171	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
172	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
173	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
174	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
175	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
176	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
177	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
178	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
179	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
180	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
181	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
182	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
183	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
184	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
185	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
186	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
187	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
188	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
189	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
190	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
191	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
192	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
193	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
194	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
195	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
196	{25, 26, 28, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
197	{25, 26, 28, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
198	{25, 26, 28, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
199	{25, 26, 28, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
200	{25, 26, 28, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
201	{25, 26, 28, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
202	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
203	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
204	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
205	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
206	{25, 26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
207	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
208	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
209	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
210	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
211	{25, 26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
212	{25, 26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
213	{25, 26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
214	{25, 26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
215	{25, 26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
216	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
217	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
218	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
219	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
220	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
221	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
222	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
223	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
224	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
225	{25, 26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
226	{25, 26, 28, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
227	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
228	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
229	{25, 26, 28, 9, 10, 11, 12, 17, 15, 23, 19}	-1
230	{25, 26, 28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	-1
231	{25, 26, 28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	-1
232	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
233	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
234	{25, 26, 28, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
235	{25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
236	{25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
237	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 19}	-1
238	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	1
239	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	1
240	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
241	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
242	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
243	{25, 26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
244	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
245	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
246	{25, 26, 28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
247	{25, 26, 28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
248	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
249	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
250	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
251	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
252	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
253	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
254	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
255	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
256	{25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
257	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
258	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
259	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
260	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
261	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
262	{25, 26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
263	{25, 26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
264	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
265	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
266	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
267	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
268	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
269	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
270	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
271	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
272	{25, 26, 28, 3, 20, 5, 17, 15, 24, 23, 19}	-1
273	{25, 26, 28, 3, 22, 5, 17, 15, 24, 23, 19}	-1
274	{25, 26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
275	{25, 26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	1
276	{25, 26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
277	{25, 26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
278	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
279	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
280	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
281	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
282	{25, 26, 28, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
283	{25, 26, 28, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
284	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
285	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
286	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
287	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
288	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
289	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
290	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
291	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
292	{25, 26, 28, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
293	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
294	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
295	{25, 26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 19}	-1
296	{25, 26, 28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
297	{25, 26, 28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
298	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
299	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
300	{25, 26, 28, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
301	{25, 26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
302	{25, 26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
303	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 19}	-1
304	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	1
305	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	1
306	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
307	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
308	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
309	{25, 26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 25 to element 19

#	Path	Direction
310	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
311	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
312	{25, 26, 28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
313	{25, 26, 28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
314	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
315	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
316	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
317	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
318	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
319	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
320	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
321	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
322	{25, 26, 28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
323	{25, 26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
324	{25, 26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
325	{25, 26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
326	{25, 26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
327	{25, 26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
328	{25, 26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
329	{25, 26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
330	{25, 26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
331	{25, 26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
332	{25, 26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
333	{25, 26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
334	{25, 26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
335	{25, 26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
336	{25, 26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
337	{25, 26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 25 to element 27

#	Path	Direction
1	{25, 26, 28, 27}	1
2	{25, 26, 28, 9, 27}	1

Appendix 4_Paths of the system_From element 26 to element 3

#	Path	Direction
1	{26, 19, 12, 1, 3}	1
2	{26, 19, 12, 1, 23, 2, 3}	1
3	{26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
4	{26, 19, 12, 17, 15, 23, 2, 3}	1
5	{26, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
6	{26, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
7	{26, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
8	{26, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{26, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{26, 19, 24, 23, 2, 3}	1
14	{26, 19, 24, 23, 7, 8, 1, 3}	-1
15	{26, 19, 24, 23, 7, 8, 2, 3}	-1
16	{26, 19, 12, 17, 15, 24, 23, 2, 3}	1
17	{26, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
18	{26, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
19	{26, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
20	{26, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
21	{26, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
22	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
23	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
24	{26, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
25	{26, 28, 3}	1
26	{26, 28, 23, 2, 3}	-1
27	{26, 28, 7, 8, 1, 3}	-1
28	{26, 28, 7, 8, 2, 3}	-1
29	{26, 28, 7, 8, 1, 23, 2, 3}	-1
30	{26, 28, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 26 to element 3

#	Path	Direction
31	{26, 28, 23, 7, 8, 2, 3}	1
32	{26, 28, 9, 7, 8, 1, 3}	1
33	{26, 28, 9, 7, 8, 2, 3}	1
34	{26, 28, 9, 7, 8, 1, 23, 2, 3}	1
35	{26, 28, 9, 10, 11, 12, 1, 3}	1
36	{26, 28, 9, 10, 11, 12, 1, 23, 2, 3}	1
37	{26, 28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
38	{26, 28, 19, 12, 1, 3}	1
39	{26, 28, 19, 12, 1, 23, 2, 3}	1
40	{26, 28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
41	{26, 28, 23, 19, 12, 1, 3}	-1
42	{26, 28, 27, 19, 12, 1, 3}	-1
43	{26, 28, 27, 19, 12, 1, 23, 2, 3}	-1
44	{26, 28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
45	{26, 28, 9, 27, 19, 12, 1, 3}	-1
46	{26, 28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
47	{26, 28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
48	{26, 28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
49	{26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
50	{26, 28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
51	{26, 28, 9, 10, 11, 12, 17, 15, 23, 2, 3}	1
52	{26, 28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
53	{26, 28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
54	{26, 28, 19, 12, 17, 15, 23, 2, 3}	1
55	{26, 28, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
56	{26, 28, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
57	{26, 28, 27, 19, 12, 17, 15, 23, 2, 3}	-1
58	{26, 28, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
59	{26, 28, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
60	{26, 28, 9, 27, 19, 12, 17, 15, 23, 2, 3}	-1
61	{26, 28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 26 to element 3

#	Path	Direction
62	{26, 28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
63	{26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3}	1
64	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
65	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
66	{26, 28, 9, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	1
67	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	-1
68	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
69	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
70	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
71	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
72	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
73	{26, 28, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
74	{26, 28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
75	{26, 28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
76	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
77	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
78	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
79	{26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1
80	{26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
81	{26, 28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
82	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
83	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
84	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
85	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1
86	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
87	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
88	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
89	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
90	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
91	{26, 28, 19, 24, 23, 2, 3}	1
92	{26, 28, 19, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 26 to element 3

#	Path	Direction
93	{26, 28, 19, 24, 23, 7, 8, 2, 3}	-1
94	{26, 28, 27, 19, 24, 23, 2, 3}	-1
95	{26, 28, 27, 19, 24, 23, 7, 8, 1, 3}	1
96	{26, 28, 27, 19, 24, 23, 7, 8, 2, 3}	1
97	{26, 28, 9, 27, 19, 24, 23, 2, 3}	-1
98	{26, 28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
99	{26, 28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
100	{26, 28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
101	{26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
102	{26, 28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
103	{26, 28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
104	{26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
105	{26, 28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
106	{26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
107	{26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
108	{26, 28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
109	{26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 2, 3}	1
110	{26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
111	{26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
112	{26, 28, 19, 12, 17, 15, 24, 23, 2, 3}	1
113	{26, 28, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
114	{26, 28, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
115	{26, 28, 27, 19, 12, 17, 15, 24, 23, 2, 3}	-1
116	{26, 28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
117	{26, 28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
118	{26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 2, 3}	-1
119	{26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
120	{26, 28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
121	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
122	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
123	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 26 to element 3

#	Path	Direction
124	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	1
125	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	-1
126	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
127	{26, 28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
128	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
129	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
130	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
131	{26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
132	{26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
133	{26, 28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
134	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
135	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
136	{26, 28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
137	{26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
138	{26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
139	{26, 28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
140	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
141	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
142	{26, 28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
143	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
144	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
145	{26, 28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
146	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
147	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
148	{26, 28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
1	{26, 19}	1
2	{26, 28, 19}	1
3	{26, 28, 23, 19}	-1
4	{26, 28, 3, 21, 1, 23, 19}	1
5	{26, 28, 3, 20, 21, 1, 23, 19}	-1
6	{26, 28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
7	{26, 28, 3, 20, 5, 6, 8, 1, 23, 19}	1
8	{26, 28, 3, 22, 5, 6, 8, 1, 23, 19}	1
9	{26, 28, 7, 8, 1, 23, 19}	-1
10	{26, 28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
11	{26, 28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
12	{26, 28, 9, 7, 8, 1, 23, 19}	1
13	{26, 28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
14	{26, 28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
15	{26, 28, 27, 19}	-1
16	{26, 28, 9, 27, 19}	-1
17	{26, 28, 3, 20, 5, 11, 12, 19}	-1
18	{26, 28, 3, 20, 5, 11, 12, 1, 23, 19}	1
19	{26, 28, 23, 2, 3, 20, 5, 11, 12, 19}	1
20	{26, 28, 3, 22, 5, 11, 12, 19}	-1
21	{26, 28, 3, 22, 5, 11, 12, 1, 23, 19}	1
22	{26, 28, 23, 2, 3, 22, 5, 11, 12, 19}	1
23	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
24	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
25	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
26	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
27	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
28	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
29	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
30	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
31	{26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
32	{26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
33	{26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
34	{26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
35	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
36	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
37	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
38	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
39	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
40	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
41	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
42	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
43	{26, 28, 3, 13, 10, 11, 12, 19}	-1
44	{26, 28, 3, 13, 10, 11, 12, 1, 23, 19}	1
45	{26, 28, 23, 2, 3, 13, 10, 11, 12, 19}	1
46	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
47	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
48	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
49	{26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
50	{26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
51	{26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
52	{26, 28, 9, 10, 11, 12, 19}	-1
53	{26, 28, 9, 10, 11, 12, 1, 23, 19}	1
54	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
55	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
56	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
57	{26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
58	{26, 28, 3, 13, 10, 14, 18, 19}	-1
59	{26, 28, 23, 2, 3, 13, 10, 14, 18, 19}	1
60	{26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
61	{26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
62	{26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1
63	{26, 28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
64	{26, 28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
65	{26, 28, 9, 10, 14, 18, 19}	-1
66	{26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
67	{26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
68	{26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
69	{26, 28, 3, 20, 5, 11, 12, 14, 18, 19}	1
70	{26, 28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
71	{26, 28, 3, 22, 5, 11, 12, 14, 18, 19}	1
72	{26, 28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
73	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
74	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
75	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
76	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
77	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
78	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
79	{26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
80	{26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
81	{26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
82	{26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
83	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
84	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
85	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
86	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
87	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
88	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
89	{26, 28, 3, 13, 10, 11, 12, 14, 18, 19}	1
90	{26, 28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
91	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
92	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
93	{26, 28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
94	{26, 28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
95	{26, 28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
96	{26, 28, 9, 10, 11, 12, 14, 18, 19}	1
97	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
98	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
99	{26, 28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
100	{26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
101	{26, 28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
102	{26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
103	{26, 28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
104	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
105	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
106	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
107	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
108	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
109	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
110	{26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
111	{26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
112	{26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
113	{26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
114	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
115	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
116	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
117	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
118	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
119	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
120	{26, 28, 3, 20, 5, 17, 15, 23, 19}	1
121	{26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
122	{26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
123	{26, 28, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
124	{26, 28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
125	{26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
126	{26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
127	{26, 28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
128	{26, 28, 3, 22, 5, 17, 15, 23, 19}	1
129	{26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
130	{26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
131	{26, 28, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
132	{26, 28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
133	{26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
134	{26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
135	{26, 28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
136	{26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
137	{26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
138	{26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
139	{26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
140	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
141	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
142	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
143	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
144	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
145	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
146	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
147	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
148	{26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
149	{26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
150	{26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
151	{26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
152	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
153	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
154	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
155	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
156	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
157	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
158	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
159	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
160	{26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
161	{26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
162	{26, 28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
163	{26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
164	{26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
165	{26, 28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
166	{26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
167	{26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
168	{26, 28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
169	{26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
170	{26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
171	{26, 28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
172	{26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	1
173	{26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
174	{26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
175	{26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
176	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	1
177	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
178	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
179	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
180	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
181	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
182	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
183	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
184	{26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	1
185	{26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
186	{26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
187	{26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
188	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	1
189	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
190	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
191	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
192	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
193	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
194	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
195	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
196	{26, 28, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
197	{26, 28, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
198	{26, 28, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
199	{26, 28, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
200	{26, 28, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
201	{26, 28, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
202	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
203	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
204	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
205	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
206	{26, 28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
207	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
208	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
209	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
210	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
211	{26, 28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
212	{26, 28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
213	{26, 28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
214	{26, 28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
215	{26, 28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
216	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
217	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
218	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
219	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
220	{26, 28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
221	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
222	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
223	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
224	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
225	{26, 28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
226	{26, 28, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
227	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
228	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
229	{26, 28, 9, 10, 11, 12, 17, 15, 23, 19}	1
230	{26, 28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
231	{26, 28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
232	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
233	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
234	{26, 28, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
235	{26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
236	{26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
237	{26, 28, 9, 10, 14, 18, 17, 15, 23, 19}	1
238	{26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	-1
239	{26, 28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	-1
240	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
241	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
242	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
243	{26, 28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
244	{26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
245	{26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
246	{26, 28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
247	{26, 28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
248	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
249	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
250	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
251	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
252	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
253	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
254	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
255	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
256	{26, 28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
257	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
258	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
259	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
260	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
261	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
262	{26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
263	{26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
264	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
265	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
266	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
267	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
268	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
269	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
270	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
271	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
272	{26, 28, 3, 20, 5, 17, 15, 24, 23, 19}	1
273	{26, 28, 3, 22, 5, 17, 15, 24, 23, 19}	1
274	{26, 28, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
275	{26, 28, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
276	{26, 28, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
277	{26, 28, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
278	{26, 28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
279	{26, 28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	1
280	{26, 28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
281	{26, 28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
282	{26, 28, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
283	{26, 28, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
284	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
285	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
286	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
287	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
288	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
289	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
290	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
291	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
292	{26, 28, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
293	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
294	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
295	{26, 28, 9, 10, 11, 12, 17, 15, 24, 23, 19}	1
296	{26, 28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
297	{26, 28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
298	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
299	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
300	{26, 28, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
301	{26, 28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
302	{26, 28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
303	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 19}	1
304	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	-1
305	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	-1
306	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
307	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
308	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
309	{26, 28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1

Appendix 4_Paths of the system_From element 26 to element 19

#	Path	Direction
310	{26, 28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
311	{26, 28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
312	{26, 28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
313	{26, 28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
314	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
315	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
316	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
317	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
318	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
319	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
320	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
321	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
322	{26, 28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
323	{26, 28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
324	{26, 28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
325	{26, 28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
326	{26, 28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
327	{26, 28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
328	{26, 28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
329	{26, 28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
330	{26, 28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
331	{26, 28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
332	{26, 28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
333	{26, 28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
334	{26, 28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
335	{26, 28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
336	{26, 28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
337	{26, 28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1

Appendix 4_Paths of the system_From element 26 to element 27

#	Path	Direction
1	{26, 28, 27}	-1
2	{26, 28, 9, 27}	-1

Appendix 4_Paths of the system_From element 27 to element 3

#	Path	Direction
1	{27, 19, 12, 1, 3}	1
2	{27, 19, 12, 1, 23, 2, 3}	1
3	{27, 19, 12, 1, 23, 7, 8, 2, 3}	-1
4	{27, 19, 12, 17, 15, 23, 2, 3}	1
5	{27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
6	{27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
7	{27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
8	{27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
9	{27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
10	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
11	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
12	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
13	{27, 19, 24, 23, 2, 3}	1
14	{27, 19, 24, 23, 7, 8, 1, 3}	-1
15	{27, 19, 24, 23, 7, 8, 2, 3}	-1
16	{27, 19, 12, 17, 15, 24, 23, 2, 3}	1
17	{27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
18	{27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
19	{27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
20	{27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
21	{27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
22	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
23	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
24	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
25	{27, 19, 12, 17, 15, 25, 26, 28, 3}	1
26	{27, 19, 12, 17, 15, 25, 26, 28, 23, 2, 3}	-1
27	{27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 3}	-1
28	{27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 2, 3}	-1
29	{27, 19, 12, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	-1
30	{27, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 27 to element 3

#	Path	Direction
31	{27, 19, 12, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	1
32	{27, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	1
33	{27, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	1
34	{27, 19, 12, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	1
35	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 3}	-1
36	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
37	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
38	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
39	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
40	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
41	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
42	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
43	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
44	{27, 19, 12, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1
45	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 3}	-1
46	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 2, 3}	1
47	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 3}	1
48	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 2, 3}	1
49	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 7, 8, 1, 23, 2, 3}	1
50	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 1, 3}	-1
51	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 23, 7, 8, 2, 3}	-1
52	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 3}	-1
53	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 2, 3}	-1
54	{27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 28, 9, 7, 8, 1, 23, 2, 3}	-1

Appendix 4_Paths of the system_From element 27 to element 19

#	Path	Direction
1	{27, 19}	1

Appendix 4_Paths of the system_From element 28 to element 3

#	Path	Direction
1	{28, 3}	1
2	{28, 23, 2, 3}	-1
3	{28, 7, 8, 1, 3}	-1
4	{28, 7, 8, 2, 3}	-1
5	{28, 7, 8, 1, 23, 2, 3}	-1
6	{28, 23, 7, 8, 1, 3}	1
7	{28, 23, 7, 8, 2, 3}	1
8	{28, 9, 7, 8, 1, 3}	1
9	{28, 9, 7, 8, 2, 3}	1
10	{28, 9, 7, 8, 1, 23, 2, 3}	1
11	{28, 9, 10, 11, 12, 1, 3}	1
12	{28, 9, 10, 11, 12, 1, 23, 2, 3}	1
13	{28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3}	-1
14	{28, 19, 12, 1, 3}	1
15	{28, 19, 12, 1, 23, 2, 3}	1
16	{28, 19, 12, 1, 23, 7, 8, 2, 3}	-1
17	{28, 23, 19, 12, 1, 3}	-1
18	{28, 27, 19, 12, 1, 3}	-1
19	{28, 27, 19, 12, 1, 23, 2, 3}	-1
20	{28, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
21	{28, 9, 27, 19, 12, 1, 3}	-1
22	{28, 9, 27, 19, 12, 1, 23, 2, 3}	-1
23	{28, 9, 27, 19, 12, 1, 23, 7, 8, 2, 3}	1
24	{28, 9, 10, 14, 18, 19, 12, 1, 3}	-1
25	{28, 9, 10, 14, 18, 19, 12, 1, 23, 2, 3}	-1
26	{28, 9, 10, 14, 18, 19, 12, 1, 23, 7, 8, 2, 3}	1
27	{28, 9, 10, 11, 12, 17, 15, 23, 2, 3}	1
28	{28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 1, 3}	-1
29	{28, 9, 10, 11, 12, 17, 15, 23, 7, 8, 2, 3}	-1
30	{28, 19, 12, 17, 15, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 28 to element 3

#	Path	Direction
31	{28, 19, 12, 17, 15, 23, 7, 8, 1, 3}	-1
32	{28, 19, 12, 17, 15, 23, 7, 8, 2, 3}	-1
33	{28, 27, 19, 12, 17, 15, 23, 2, 3}	-1
34	{28, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
35	{28, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
36	{28, 9, 27, 19, 12, 17, 15, 23, 2, 3}	-1
37	{28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
38	{28, 9, 27, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
39	{28, 9, 10, 14, 18, 17, 15, 23, 2, 3}	1
40	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
41	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
42	{28, 9, 10, 14, 18, 17, 15, 23, 19, 12, 1, 3}	1
43	{28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 2, 3}	-1
44	{28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 1, 3}	1
45	{28, 9, 10, 14, 18, 19, 12, 17, 15, 23, 7, 8, 2, 3}	1
46	{28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 2, 3}	-1
47	{28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
48	{28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
49	{28, 19, 12, 14, 18, 17, 15, 23, 2, 3}	-1
50	{28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
51	{28, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
52	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	-1
53	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	1
54	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	1
55	{28, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1
56	{28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
57	{28, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
58	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
59	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
60	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
61	{28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 2, 3}	1

Appendix 4_Paths of the system_From element 28 to element 3

#	Path	Direction
62	{28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
63	{28, 9, 27, 19, 12, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
64	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 2, 3}	1
65	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3}	-1
66	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3}	-1
67	{28, 19, 24, 23, 2, 3}	1
68	{28, 19, 24, 23, 7, 8, 1, 3}	-1
69	{28, 19, 24, 23, 7, 8, 2, 3}	-1
70	{28, 27, 19, 24, 23, 2, 3}	-1
71	{28, 27, 19, 24, 23, 7, 8, 1, 3}	1
72	{28, 27, 19, 24, 23, 7, 8, 2, 3}	1
73	{28, 9, 27, 19, 24, 23, 2, 3}	-1
74	{28, 9, 27, 19, 24, 23, 7, 8, 1, 3}	1
75	{28, 9, 27, 19, 24, 23, 7, 8, 2, 3}	1
76	{28, 9, 10, 11, 12, 19, 24, 23, 2, 3}	-1
77	{28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 1, 3}	1
78	{28, 9, 10, 11, 12, 19, 24, 23, 7, 8, 2, 3}	1
79	{28, 9, 10, 14, 18, 19, 24, 23, 2, 3}	-1
80	{28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 1, 3}	1
81	{28, 9, 10, 14, 18, 19, 24, 23, 7, 8, 2, 3}	1
82	{28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 2, 3}	1
83	{28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 1, 3}	-1
84	{28, 9, 10, 11, 12, 14, 18, 19, 24, 23, 7, 8, 2, 3}	-1
85	{28, 9, 10, 11, 12, 17, 15, 24, 23, 2, 3}	1
86	{28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
87	{28, 9, 10, 11, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
88	{28, 19, 12, 17, 15, 24, 23, 2, 3}	1
89	{28, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	-1
90	{28, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	-1
91	{28, 27, 19, 12, 17, 15, 24, 23, 2, 3}	-1
92	{28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1

Appendix 4_Paths of the system_From element 28 to element 3

#	Path	Direction
93	{28, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
94	{28, 9, 27, 19, 12, 17, 15, 24, 23, 2, 3}	-1
95	{28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
96	{28, 9, 27, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
97	{28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
98	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
99	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
100	{28, 9, 10, 14, 18, 17, 15, 24, 23, 19, 12, 1, 3}	1
101	{28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 2, 3}	-1
102	{28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 1, 3}	1
103	{28, 9, 10, 14, 18, 19, 12, 17, 15, 24, 23, 7, 8, 2, 3}	1
104	{28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
105	{28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
106	{28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
107	{28, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	-1
108	{28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
109	{28, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
110	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	-1
111	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	1
112	{28, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	1
113	{28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
114	{28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
115	{28, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
116	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
117	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
118	{28, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
119	{28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 2, 3}	1
120	{28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1
121	{28, 9, 27, 19, 12, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
122	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 2, 3}	1
123	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3}	-1

Appendix 4_Paths of the system_From element 28 to element 3

#	Path	Direction
124	{28, 9, 27, 19, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3}	-1
125	{28, 9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
126	{28, 9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
127	{28, 9, 10, 11, 12, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
128	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 3}	1
129	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 2, 3}	1
130	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 12, 1, 23, 7, 8, 2, 3}	-1
131	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	1
132	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	-1
133	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	-1
134	{28, 9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 2, 3}	-1
135	{28, 9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 1, 3}	1
136	{28, 9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19, 24, 23, 7, 8, 2, 3}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
1	{28, 19}	1
2	{28, 23, 19}	-1
3	{28, 3, 21, 1, 23, 19}	1
4	{28, 3, 20, 21, 1, 23, 19}	-1
5	{28, 3, 22, 4, 6, 8, 1, 23, 19}	-1
6	{28, 3, 20, 5, 6, 8, 1, 23, 19}	1
7	{28, 3, 22, 5, 6, 8, 1, 23, 19}	1
8	{28, 7, 8, 1, 23, 19}	-1
9	{28, 7, 8, 2, 3, 21, 1, 23, 19}	-1
10	{28, 7, 8, 2, 3, 20, 21, 1, 23, 19}	1
11	{28, 9, 7, 8, 1, 23, 19}	1
12	{28, 9, 7, 8, 2, 3, 21, 1, 23, 19}	1
13	{28, 9, 7, 8, 2, 3, 20, 21, 1, 23, 19}	-1
14	{28, 27, 19}	-1
15	{28, 9, 27, 19}	-1
16	{28, 3, 20, 5, 11, 12, 19}	-1
17	{28, 3, 20, 5, 11, 12, 1, 23, 19}	1
18	{28, 23, 2, 3, 20, 5, 11, 12, 19}	1
19	{28, 3, 22, 5, 11, 12, 19}	-1
20	{28, 3, 22, 5, 11, 12, 1, 23, 19}	1
21	{28, 23, 2, 3, 22, 5, 11, 12, 19}	1
22	{28, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
23	{28, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
24	{28, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	-1
25	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	1
26	{28, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
27	{28, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
28	{28, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	-1
29	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	1
30	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
31	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
32	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
33	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
34	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 19}	-1
35	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 19}	-1
36	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 1, 23, 19}	1
37	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 19}	-1
38	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 19}	-1
39	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 19}	-1
40	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 1, 23, 19}	1
41	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 19}	-1
42	{28, 3, 13, 10, 11, 12, 19}	-1
43	{28, 3, 13, 10, 11, 12, 1, 23, 19}	1
44	{28, 23, 2, 3, 13, 10, 11, 12, 19}	1
45	{28, 7, 8, 1, 3, 13, 10, 11, 12, 19}	1
46	{28, 7, 8, 2, 3, 13, 10, 11, 12, 19}	1
47	{28, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	-1
48	{28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	1
49	{28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
50	{28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
51	{28, 9, 10, 11, 12, 19}	-1
52	{28, 9, 10, 11, 12, 1, 23, 19}	1
53	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 19}	-1
54	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 19}	-1
55	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 1, 23, 19}	1
56	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 19}	-1
57	{28, 3, 13, 10, 14, 18, 19}	-1
58	{28, 23, 2, 3, 13, 10, 14, 18, 19}	1
59	{28, 7, 8, 1, 3, 13, 10, 14, 18, 19}	1
60	{28, 7, 8, 2, 3, 13, 10, 14, 18, 19}	1
61	{28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
62	{28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
63	{28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
64	{28, 9, 10, 14, 18, 19}	-1
65	{28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 19}	-1
66	{28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 19}	-1
67	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 19}	-1
68	{28, 3, 20, 5, 11, 12, 14, 18, 19}	1
69	{28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
70	{28, 3, 22, 5, 11, 12, 14, 18, 19}	1
71	{28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
72	{28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	-1
73	{28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
74	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	-1
75	{28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	-1
76	{28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
77	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	-1
78	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
79	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
80	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
81	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
82	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 19}	1
83	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
84	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 19}	1
85	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 19}	1
86	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
87	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 19}	1
88	{28, 3, 13, 10, 11, 12, 14, 18, 19}	1
89	{28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
90	{28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	-1
91	{28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1
92	{28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
93	{28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
94	{28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
95	{28, 9, 10, 11, 12, 14, 18, 19}	1
96	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 19}	1
97	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
98	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 19}	1
99	{28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
100	{28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
101	{28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
102	{28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
103	{28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
104	{28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
105	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
106	{28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
107	{28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
108	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	-1
109	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
110	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
111	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
112	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
113	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
114	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
115	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
116	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
117	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
118	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 19}	1
119	{28, 3, 20, 5, 17, 15, 23, 19}	1
120	{28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
121	{28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
122	{28, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
123	{28, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
124	{28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
125	{28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
126	{28, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
127	{28, 3, 22, 5, 17, 15, 23, 19}	1
128	{28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
129	{28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
130	{28, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
131	{28, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
132	{28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
133	{28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
134	{28, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
135	{28, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	-1
136	{28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
137	{28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
138	{28, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
139	{28, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	-1
140	{28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
141	{28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
142	{28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
143	{28, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
144	{28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	1
145	{28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	1
146	{28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
147	{28, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	-1
148	{28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
149	{28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
150	{28, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
151	{28, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	-1
152	{28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
153	{28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	-1
154	{28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
155	{28, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
156	{28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	1
157	{28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	1
158	{28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	-1
159	{28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
160	{28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
161	{28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
162	{28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
163	{28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
164	{28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
165	{28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
166	{28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
167	{28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
168	{28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
169	{28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
170	{28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
171	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 23, 19}	1
172	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
173	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
174	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
175	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 23, 19}	1
176	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
177	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
178	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
179	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
180	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 19}	-1
181	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 14, 18, 19}	-1
182	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
183	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 23, 19}	1
184	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
185	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
186	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
187	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 23, 19}	1
188	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
189	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 1, 23, 19}	1
190	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
191	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
192	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 19}	-1
193	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 14, 18, 19}	-1
194	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 13, 10, 11, 12, 14, 18, 19}	1
195	{28, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
196	{28, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
197	{28, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
198	{28, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
199	{28, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
200	{28, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
201	{28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
202	{28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
203	{28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	-1
204	{28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
205	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
206	{28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
207	{28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
208	{28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	-1
209	{28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
210	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	1
211	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
212	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
213	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
214	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
215	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
216	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
217	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 23, 19}	1
218	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
219	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
220	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
221	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
222	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 23, 19}	1
223	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
224	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 13, 10, 14, 18, 19}	-1
225	{28, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
226	{28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
227	{28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	-1
228	{28, 9, 10, 11, 12, 17, 15, 23, 19}	1
229	{28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 23, 19}	1
230	{28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 23, 19}	1
231	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
232	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 23, 19}	1
233	{28, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
234	{28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
235	{28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	-1
236	{28, 9, 10, 14, 18, 17, 15, 23, 19}	1
237	{28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 20, 5, 11, 12, 19}	-1
238	{28, 9, 10, 14, 18, 17, 15, 23, 2, 3, 22, 5, 11, 12, 19}	-1
239	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
240	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
241	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
242	{28, 9, 10, 14, 18, 17, 15, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
243	{28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
244	{28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 23, 19}	1
245	{28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
246	{28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
247	{28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
248	{28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
249	{28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
250	{28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	1
251	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
252	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
253	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
254	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 23, 19}	-1
255	{28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
256	{28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
257	{28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	1
258	{28, 9, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
259	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
260	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 23, 19}	-1
261	{28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
262	{28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
263	{28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
264	{28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
265	{28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
266	{28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	1
267	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
268	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
269	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
270	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 23, 19}	-1
271	{28, 3, 20, 5, 17, 15, 24, 23, 19}	1
272	{28, 3, 22, 5, 17, 15, 24, 23, 19}	1
273	{28, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	-1
274	{28, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	-1
275	{28, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	-1
276	{28, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	-1
277	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
278	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
279	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
280	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 24, 23, 19}	1
281	{28, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
282	{28, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
283	{28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
284	{28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	-1
285	{28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
286	{28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	-1
287	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
288	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 24, 23, 19}	1
289	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
290	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 24, 23, 19}	1
291	{28, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
292	{28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
293	{28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	-1
294	{28, 9, 10, 11, 12, 17, 15, 24, 23, 19}	1
295	{28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 24, 23, 19}	1
296	{28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 24, 23, 19}	1
297	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
298	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 24, 23, 19}	1
299	{28, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
300	{28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
301	{28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
302	{28, 9, 10, 14, 18, 17, 15, 24, 23, 19}	1
303	{28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 20, 5, 11, 12, 19}	-1
304	{28, 9, 10, 14, 18, 17, 15, 24, 23, 2, 3, 22, 5, 11, 12, 19}	-1
305	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 20, 5, 11, 12, 19}	1
306	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 20, 5, 11, 12, 19}	1
307	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 1, 3, 22, 5, 11, 12, 19}	1
308	{28, 9, 10, 14, 18, 17, 15, 24, 23, 7, 8, 2, 3, 22, 5, 11, 12, 19}	1
309	{28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
310	{28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
311	{28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
312	{28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
313	{28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
314	{28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
315	{28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
316	{28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
317	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
318	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
319	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
320	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
321	{28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
322	{28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
323	{28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	1
324	{28, 9, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
325	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
326	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 24, 23, 19}	-1
327	{28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
328	{28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
329	{28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
330	{28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
331	{28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
332	{28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	1
333	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
334	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
335	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
336	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 24, 23, 19}	-1
337	{28, 3, 20, 5, 17, 15, 25, 26, 19}	1
338	{28, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
339	{28, 3, 22, 5, 17, 15, 25, 26, 19}	1
340	{28, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
341	{28, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	-1
342	{28, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
343	{28, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
344	{28, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	-1
345	{28, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
346	{28, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
347	{28, 23, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
348	{28, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
349	{28, 23, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
350	{28, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
351	{28, 9, 7, 8, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
352	{28, 9, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
353	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
354	{28, 9, 7, 8, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
355	{28, 9, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
356	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
357	{28, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
358	{28, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
359	{28, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
360	{28, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
361	{28, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
362	{28, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
363	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	-1
364	{28, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
365	{28, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
366	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	-1
367	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
368	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
369	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
370	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
371	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
372	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
373	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 17, 15, 25, 26, 19}	1
374	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
375	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
376	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 17, 15, 25, 26, 19}	1
377	{28, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
378	{28, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
379	{28, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
380	{28, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
381	{28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	-1
382	{28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
383	{28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
384	{28, 9, 10, 11, 12, 17, 15, 25, 26, 19}	1
385	{28, 9, 10, 11, 12, 1, 3, 20, 5, 17, 15, 25, 26, 19}	1
386	{28, 9, 10, 11, 12, 1, 23, 2, 3, 20, 5, 17, 15, 25, 26, 19}	1
387	{28, 9, 10, 11, 12, 1, 3, 22, 5, 17, 15, 25, 26, 19}	1
388	{28, 9, 10, 11, 12, 1, 23, 2, 3, 22, 5, 17, 15, 25, 26, 19}	1
389	{28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 20, 5, 17, 15, 25, 26, 19}	-1
390	{28, 9, 10, 11, 12, 1, 23, 7, 8, 2, 3, 22, 5, 17, 15, 25, 26, 19}	-1
391	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
392	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
393	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 17, 15, 25, 26, 19}	1
394	{28, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
395	{28, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
396	{28, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
397	{28, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
398	{28, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
399	{28, 23, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
400	{28, 23, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
401	{28, 9, 10, 14, 18, 17, 15, 25, 26, 19}	1
402	{28, 9, 7, 8, 1, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
403	{28, 9, 7, 8, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
404	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
405	{28, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
406	{28, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
407	{28, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
408	{28, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
409	{28, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
410	{28, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
411	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
412	{28, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
413	{28, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
414	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
415	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
416	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
417	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
418	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
419	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
420	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
421	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
422	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
423	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
424	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
425	{28, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
426	{28, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
427	{28, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
428	{28, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
429	{28, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	1
430	{28, 23, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
431	{28, 23, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
432	{28, 9, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
433	{28, 9, 7, 8, 1, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 19

#	Path	Direction
434	{28, 9, 7, 8, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
435	{28, 9, 7, 8, 1, 23, 2, 3, 13, 10, 11, 12, 14, 18, 17, 15, 25, 26, 19}	-1
436	{28, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
437	{28, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
438	{28, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
439	{28, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
440	{28, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
441	{28, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
442	{28, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
443	{28, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
444	{28, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
445	{28, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	1
446	{28, 23, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
447	{28, 23, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
448	{28, 23, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
449	{28, 23, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
450	{28, 9, 7, 8, 1, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
451	{28, 9, 7, 8, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
452	{28, 9, 7, 8, 1, 23, 2, 3, 20, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
453	{28, 9, 7, 8, 1, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
454	{28, 9, 7, 8, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1
455	{28, 9, 7, 8, 1, 23, 2, 3, 22, 5, 11, 12, 16, 13, 10, 14, 18, 17, 15, 25, 26, 19}	-1

Appendix 4_Paths of the system_From element 28 to element 27

#	Path	Direction
1	{28, 27}	-1
2	{28, 9, 27}	-1

Appendix 5: Lengths of paths

This chapter shows the length of identified paths of the systemic financial crisis model. The details of this chapter are interpreted in Chapter 5.3. The background of this kind of analysis is described in Chapter 3.4.4.

There are two tables for each element. One table shows the positive paths and the second table contains negative paths. The tables show the length of a paths in the first column and the respective number of the cycle according to the respective lists of Appendix 4.

Appendix 5_Length of paths_From element 1 to element 3_Negative paths

Length	Path number
6	{3}
12	{7}
13	{5}
15	{10}
16	{9}
19	{12}

Appendix 5_Length of paths_From element 1 to element 3_Positive paths

Length	Path number
2	{1}
4	{2}
10	{4}
14	{6}
15	{8}
18	{11}

Appendix 5_Length of paths_From element 1 to element 19_Negative paths

Length	Path number
7	{2, 4, 8, 11}
9	{3, 5, 9, 12}
11	{30, 31, 37, 38, 109, 110, 122, 123}
12	{59, 60, 61, 111, 124}
13	{18, 19, 22, 33, 34, 40, 41, 50, 53, 70, 71, 72, 79, 80, 93, 95, 99, 116, 129, 147, 148, 156, 157, 173, 174, 183, 184}
14	{112, 113, 117, 125, 126, 130, 134, 140, 149, 158, 175, 185, 192, 199, 212}
15	{51, 54, 62, 63, 85, 86, 89, 92, 94, 96, 100, 152, 161, 177, 187}
16	{27, 28, 73, 74, 102, 104, 118, 119, 131, 132, 150, 153, 159, 162, 164, 168, 178, 179, 188, 189, 196, 203, 216}
17	{45, 48, 222, 229}
18	{103, 105, 154, 163}
19	{207, 210, 220, 226, 233}
20	{139, 145, 208, 211, 221}
22	{237, 240}
23	{238, 241}

Appendix 5_Length of paths_From element 1 to element 19_Positive paths

Length	Path number
3	{1}
8	{29, 36}
9	{14, 16, 20, 64, 65, 75, 77}
10	{49, 52, 57, 58, 108, 121}
11	{6, 7, 10, 13, 15, 17, 21, 66, 67, 68, 69, 76, 78, 81, 83, 87, 90}
12	{23, 25, 115, 128, 146, 155, 172, 182}
13	{32, 39, 82, 84, 88, 91}
14	{24, 26, 151, 160, 176, 186}
15	{35, 42, 43, 44, 46, 47, 135, 141, 193, 194, 200, 201, 213, 214}
16	{114, 127, 136, 142, 195, 202, 215}
17	{55, 56, 97, 98, 101, 165, 169, 180, 190, 197, 204, 217}
18	{120, 133, 137, 138, 143, 144, 166, 170, 181, 191, 198, 205, 206, 209, 218, 219, 223, 224, 230, 231}
19	{225, 232}
20	{106, 107, 167, 171, 227, 234}
21	{228, 235, 236, 239}

Appendix 5_Length of paths_From element 1 to element 27_Negative paths

Length	Path number
10	{1, 5, 67}
11	{2, 6, 68}
12	{3, 7, 13, 17, 25, 31}
13	{4, 8, 14, 18, 26, 32}
14	{15, 19, 27, 33}
15	{16, 20, 28, 34}
18	{45, 47, 53, 77}
19	{46, 48, 54, 78}
21	{63, 65}
22	{64, 66}

Appendix 5_Length of paths_From element 1 to element 27_Positive paths

Length	Path number
12	{69}
13	{70}
14	{9, 11, 37, 41, 49, 73}
15	{10, 12, 38, 42, 50, 71, 74}
16	{21, 23, 29, 35, 39, 43, 51, 72, 75}
17	{22, 24, 30, 36, 40, 44, 52, 55, 59, 76}
18	{56, 60}
19	{57, 61}
20	{58, 62}

Appendix 5_Length of paths_From element 2 to element 3_Negative paths

Length	Path number
2	{1}

Appendix 5_Length of paths_From element 2 to element 3_Positive paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 2 to element 19_Negative paths

Length	Path number
6	{1}
8	{18, 23}
9	{4, 5, 7, 9, 11, 13, 14, 15, 39, 40, 50, 51}
10	{28, 30, 32, 33, 61, 71}
11	{41, 42, 43, 44, 52, 53, 54, 55}
12	{16, 17, 81, 88, 95, 101}
13	{20, 22, 25, 27}
15	{64, 74, 108, 111, 114, 117, 120, 123}
16	{68, 70, 78, 80, 112, 118, 124}
17	{84, 91, 98, 104}
18	{109, 115, 121, 126, 129, 132, 135}
19	{130, 136}
21	{127, 133}

Appendix 5_Length of paths_From element 2 to element 19_Positive paths

Length	Path number
7	{2, 6, 8, 10, 12}
9	{3}
11	{19, 21, 24, 26, 62, 65, 72, 75}
12	{34, 35, 36, 66, 76}
13	{29, 31, 45, 46, 47, 56, 57, 58, 82, 85, 89, 92, 96, 99, 102, 105}
14	{63, 67, 69, 73, 77, 79, 86, 93, 100, 106, 107, 113, 119}
15	{37, 38}
16	{48, 49, 59, 60, 83, 87, 90, 94, 97, 103}
17	{125, 131}
19	{110, 116, 122}
22	{128, 134}

Appendix 5_Length of paths_From element 2 to element 27_Negative paths

Length	Path number
14	{13, 23, 25, 27, 29}
15	{14, 24, 26, 28, 30, 35}
16	{15, 36}
17	{16, 31, 33}
18	{32, 34, 37, 47, 51}
19	{38, 48, 52}
21	{49, 53}
22	{50, 54}

Appendix 5_Length of paths_From element 2 to element 27_Positive paths

Length	Path number
10	{1, 3}
11	{2, 4}
12	{5, 7, 9, 21}
13	{6, 8, 10, 11, 22}
14	{12}
16	{17, 19, 39}
17	{18, 20, 40}
18	{43}
19	{41, 44}
20	{42}
21	{45}
22	{46}

Appendix 5_Length of paths_From element 3 to element 19_Negative paths

Length	Path number
6	{2, 6, 8, 10, 12}
8	{3}
10	{19, 21, 24, 26, 62, 65, 72, 75}
11	{34, 35, 36, 66, 76}
12	{29, 31, 45, 46, 47, 56, 57, 58, 82, 85, 89, 92, 96, 99, 102, 105}
13	{63, 67, 69, 73, 77, 79, 86, 93, 100, 106, 107, 113, 119}
14	{37, 38}
15	{48, 49, 59, 60, 83, 87, 90, 94, 97, 103}
16	{125, 131}
18	{110, 116, 122}
21	{128, 134}

Appendix 5_Length of paths_From element 3 to element 19_Positive paths

Length	Path number
5	{1}
7	{18, 23}
8	{4, 5, 7, 9, 11, 13, 14, 15, 39, 40, 50, 51}
9	{28, 30, 32, 33, 61, 71}
10	{41, 42, 43, 44, 52, 53, 54, 55}
11	{16, 17, 81, 88, 95, 101}
12	{20, 22, 25, 27}
14	{64, 74, 108, 111, 114, 117, 120, 123}
15	{68, 70, 78, 80, 112, 118, 124}
16	{84, 91, 98, 104}
17	{109, 115, 121, 126, 129, 132, 135}
18	{130, 136}
20	{127, 133}

Appendix 5_Length of paths_From element 3 to element 27_Negative paths

Length	Path number
9	{1, 3}
10	{2, 4}
11	{5, 7, 9, 21}
12	{6, 8, 10, 11, 22}
13	{12}
15	{17, 19, 39}
16	{18, 20, 40}
17	{43}
18	{41, 44}
19	{42}
20	{45}
21	{46}

Appendix 5_Length of paths_From element 3 to element 27_Positive paths

Length	Path number
13	{13, 23, 25, 27, 29}
14	{14, 24, 26, 28, 30, 35}
15	{15, 36}
16	{16, 31, 33}
17	{32, 34, 37, 47, 51}
18	{38, 48, 52}
20	{49, 53}
21	{50, 54}

Appendix 5_Length of paths_From element 4 to element 3_Negative paths

Length	Path number
5	{1, 2}
7	{3}
13	{4}

Appendix 5_Length of paths_From element 4 to element 3_Positive paths

Length	Path number
15	{5}
18	{6}

Appendix 5_Length of paths_From element 4 to element 19_Negative paths

Length	Path number
6	{1}
9	{2}
11	{34, 38, 46, 50}
12	{6, 10, 14, 19, 20, 22, 23, 25, 26, 82, 83, 84, 85, 104, 105, 107, 108}
13	{58, 60, 63, 65, 68, 69, 70, 71, 137, 144, 158, 165}
14	{21, 24, 27, 86, 87, 88, 89, 90, 91, 92, 93, 106, 109, 110, 111, 113, 114, 116, 117, 119, 120}
15	{28, 29, 31, 32, 152, 173, 179, 184, 193, 198, 207, 211, 218, 222}
16	{37, 40, 42, 49, 52, 54, 112, 115, 118, 121}
17	{30, 33, 189, 203, 215, 226}
18	{45, 57, 230, 231, 234, 235, 241, 242, 245, 246, 252, 253, 256, 257}
19	{143, 149, 151, 164, 170, 172, 232, 236, 243, 247, 254, 258}
20	{238, 249, 260}
21	{157, 178, 239, 250, 261, 263, 264, 267, 268, 274, 275, 278, 279}
22	{265, 269, 276, 280}
23	{271, 282}
24	{272, 283}

Appendix 5_Length of paths_From element 4 to element 19_Positive paths

Length	Path number
10	{3, 4, 5, 8, 9, 12, 13, 16, 17}
12	{7, 11, 15, 18}
14	{35, 36, 39, 41, 47, 48, 51, 53, 138, 139, 145, 146, 159, 160, 166, 167}
15	{72, 73, 74, 75, 76, 77, 140, 147, 161, 168}
16	{43, 44, 55, 56, 59, 61, 64, 66, 94, 95, 96, 97, 98, 99, 122, 123, 125, 126, 128, 129, 153, 174, 180, 181, 185, 186, 194, 195, 199, 200, 208, 209, 212, 213, 219, 220, 223, 224}
17	{141, 142, 148, 150, 154, 162, 163, 169, 171, 175, 182, 187, 196, 201, 210, 214, 221, 225, 229, 233, 240, 244, 251, 255}
18	{62, 67, 78, 79, 80, 81, 124, 127, 130, 190, 204, 216, 227}
19	{100, 101, 102, 103, 131, 132, 134, 135, 155, 156, 176, 177, 183, 188, 191, 197, 202, 205, 217, 228, 237, 248, 259}
20	{262, 266, 273, 277}
21	{133, 136, 192, 206}
22	{270, 281}

Appendix 5_Length of paths_From element 4 to element 27_Negative paths

Length	Path number
15	{79}
16	{80}
17	{35, 39, 43, 49, 51, 55, 57, 61, 63}
18	{36, 40, 44, 50, 52, 56, 58, 62, 64, 81, 83}
19	{47, 53, 59, 65, 82, 84}
20	{48, 54, 60, 66, 67, 69, 73, 75}
21	{68, 70, 74, 76, 85}
22	{71, 77, 86}
23	{72, 78}

Appendix 5_Length of paths_From element 4 to element 27_Positive paths

Length	Path number
13	{1, 3, 7, 9, 31}
14	{2, 4, 8, 10, 32}
15	{5, 11, 13, 15, 19, 21, 25, 27, 37, 41}
16	{6, 12, 14, 16, 20, 22, 26, 28, 33, 38, 42}
17	{17, 23, 29, 34, 45}
18	{18, 24, 30, 46}
19	{87}
20	{88}
22	{89}
23	{90}

Appendix 5_Length of paths_From element 5 to element 3_Negative paths

Length	Path number
8	{8, 9, 26}
9	{6, 36, 37, 76}
10	{18, 19, 20, 77, 78}
11	{14, 49, 50, 54, 91, 92, 120, 142}
12	{30, 31, 39, 42, 64, 65, 79, 95, 104, 121, 122}
13	{12, 15, 23, 62, 93, 102, 103, 107}
14	{51, 57, 67, 68, 69, 90, 96, 98, 123, 132, 161}
15	{33, 34, 110, 113, 130, 131, 135, 147, 148, 149, 150, 152, 180}
16	{46, 47, 87, 99}
17	{72, 138, 151}
18	{156, 157, 166, 167, 168, 169, 171, 181}
19	{117, 118, 159, 160}
20	{170}
21	{175, 176}
22	{178, 179}

Appendix 5_Length of paths_From element 5 to element 3_Positive paths

Length	Path number
5	{1, 2, 4}
6	{7}
7	{3, 5, 35, 75}
8	{13, 17}
9	{10, 38, 48, 60, 119}
10	{27, 28, 29, 63, 88}
11	{11, 61, 80, 81, 82, 83, 101}
12	{21, 22, 66, 85, 89}
13	{32, 55, 56, 84, 124, 125, 126, 127, 129, 141, 143}
14	{40, 41, 43, 44, 45, 86, 105, 106, 144, 145}
15	{16, 24, 25, 94, 108, 109, 128}
16	{52, 53, 58, 59, 70, 71, 97, 133, 134, 146, 155, 162}
17	{111, 112, 114, 115, 116, 136, 137, 153, 154, 158, 163, 164}
18	{100}
19	{73, 74, 139, 140, 165, 174}
20	{172, 173, 177}

Appendix 5_Length of paths_From element 5 to element 19_Negative paths

Length	Path number
4	{4}
8	{22, 27, 89, 99}
9	{44, 100}
10	{3, 6, 7, 10, 11, 14, 36, 67, 80, 139, 149}
11	{24, 28, 93, 110, 123, 150, 184}
12	{9, 12, 15, 48, 50, 53, 91, 101, 116}
13	{37, 71, 87, 143, 158}
14	{60, 92, 94, 141, 151, 218}
15	{33, 34, 46, 47, 186}
16	{57, 58, 69, 70, 84, 85, 98, 108, 109, 112, 113, 121, 122, 124, 125, 128, 142, 144, 163, 164, 167, 168, 174, 175, 178, 179, 192, 198, 199}
17	{106, 129, 130, 165, 169, 176, 180, 200, 207, 211}
18	{83, 86, 115, 126, 148, 156, 157, 159, 160, 171, 182, 202, 220}
19	{131, 172, 183, 191, 193, 203, 204, 215, 226}
20	{161}
22	{225, 227}

Appendix 5_Length of paths_From element 5 to element 19_Positive paths

Length	Path number
5	{21}
6	{1, 5, 13, 49, 72}
7	{35, 88}
8	{59, 73}
9	{2, 20, 138}
10	{23, 31}
11	{90}
12	{8, 17, 18, 96, 185, 195}
13	{25, 26, 29, 30, 32, 40, 41, 42, 43, 45, 111, 134, 140, 196}
14	{16, 19, 51, 52, 54, 55, 56, 63, 64, 65, 66, 68, 74, 75, 77, 78, 81, 102, 103, 117, 127, 146}
15	{38, 39, 95, 97, 104, 105, 118, 119, 162, 166, 173, 177, 189, 197, 219, 229}
16	{61, 62, 76, 79, 82, 152, 187, 230}
17	{107, 120, 145, 147, 153, 154, 170, 181, 201}
18	{114, 132, 133, 135, 136, 188, 190, 208, 209, 212, 213, 223}
19	{155, 210, 214, 221}
20	{137, 194, 205, 216}
21	{206, 217, 222, 224}
23	{228}

Appendix 5_Length of paths_From element 5 to element 27_Negative paths

Length	Path number
7	{1}
8	{2}
9	{3}
10	{4}
13	{11}
14	{12}
15	{5, 7, 17, 21, 31}
16	{6, 8, 13, 18, 22, 32}
17	{9, 14, 25, 33}
18	{10, 26, 34}
19	{53}
20	{54, 59, 61}
21	{60, 62}
22	{55}
23	{56}

Appendix 5_Length of paths_From element 5 to element 27_Positive paths

Length	Path number
11	{29}
12	{30}
14	{43}
15	{44, 45}
16	{46}
17	{15, 19, 23, 37, 39}
18	{16, 20, 24, 38, 40, 47, 49, 57}
19	{27, 35, 41, 48, 50, 58}
20	{28, 36, 42}
21	{51}
22	{52}

Appendix 5_Length of paths_From element 6 to element 3_Negative paths

Length	Path number
14	{5}
17	{6}

Appendix 5_Length of paths_From element 6 to element 3_Positive paths

Length	Path number
4	{1, 2}
6	{3}
12	{4}

Appendix 5_Length of paths_From element 6 to element 19_Negative paths

Length	Path number
9	{3, 4, 5, 8, 9, 12, 13, 16, 17}
11	{7, 11, 15, 18}
13	{35, 36, 39, 41, 47, 48, 51, 53, 138, 139, 145, 146, 159, 160, 166, 167}
14	{72, 73, 74, 75, 76, 77, 140, 147, 161, 168}
15	{43, 44, 55, 56, 59, 61, 64, 66, 94, 95, 96, 97, 98, 99, 122, 123, 125, 126, 128, 129, 153, 174, 180, 181, 185, 186, 194, 195, 199, 200, 208, 209, 212, 213, 219, 220, 223, 224}
16	{141, 142, 148, 150, 154, 162, 163, 169, 171, 175, 182, 187, 196, 201, 210, 214, 221, 225, 229, 233, 240, 244, 251, 255}
17	{62, 67, 78, 79, 80, 81, 124, 127, 130, 190, 204, 216, 227}
18	{100, 101, 102, 103, 131, 132, 134, 135, 155, 156, 176, 177, 183, 188, 191, 197, 202, 205, 217, 228, 237, 248, 259}
19	{262, 266, 273, 277}
20	{133, 136, 192, 206}
21	{270, 281}

Appendix 5_Length of paths_From element 6 to element 19_Positive paths

Length	Path number
5	{1}
8	{2}
10	{34, 38, 46, 50}
11	{6, 10, 14, 19, 20, 22, 23, 25, 26, 82, 83, 84, 85, 104, 105, 107, 108}
12	{58, 60, 63, 65, 68, 69, 70, 71, 137, 144, 158, 165}
13	{21, 24, 27, 86, 87, 88, 89, 90, 91, 92, 93, 106, 109, 110, 111, 113, 114, 116, 117, 119, 120}
14	{28, 29, 31, 32, 152, 173, 179, 184, 193, 198, 207, 211, 218, 222}
15	{37, 40, 42, 49, 52, 54, 112, 115, 118, 121}
16	{30, 33, 189, 203, 215, 226}
17	{45, 57, 230, 231, 234, 235, 241, 242, 245, 246, 252, 253, 256, 257}
18	{143, 149, 151, 164, 170, 172, 232, 236, 243, 247, 254, 258}
19	{238, 249, 260}
20	{157, 178, 239, 250, 261, 263, 264, 267, 268, 274, 275, 278, 279}
21	{265, 269, 276, 280}
22	{271, 282}
23	{272, 283}

Appendix 5_Length of paths_From element 6 to element 27_Negative paths

Length	Path number
12	{1, 3, 7, 9, 31}
13	{2, 4, 8, 10, 32}
14	{5, 11, 13, 15, 19, 21, 25, 27, 37, 41}
15	{6, 12, 14, 16, 20, 22, 26, 28, 33, 38, 42}
16	{17, 23, 29, 34, 45}
17	{18, 24, 30, 46}
18	{87}
19	{88}
21	{89}
22	{90}

Appendix 5_Length of paths_From element 6 to element 27_Positive paths

Length	Path number
14	{79}
15	{80}
16	{35, 39, 43, 49, 51, 55, 57, 61, 63}
17	{36, 40, 44, 50, 52, 56, 58, 62, 64, 81, 83}
18	{47, 53, 59, 65, 82, 84}
19	{48, 54, 60, 66, 67, 69, 73, 75}
20	{68, 70, 74, 76, 85}
21	{71, 77, 86}
22	{72, 78}

Appendix 5_Length of paths_From element 7 to element 3_Negative paths

Length	Path number
4	{1, 2}
6	{3}
12	{4}

Appendix 5_Length of paths_From element 7 to element 3_Positive paths

Length	Path number
14	{5}
17	{6}

Appendix 5_Length of paths_From element 7 to element 19_Negative paths

Length	Path number
5	{1}
8	{2}
10	{34, 38, 46, 50}
11	{6, 10, 14, 19, 20, 22, 23, 25, 26, 82, 83, 84, 85, 104, 105, 107, 108}
12	{58, 60, 63, 65, 68, 69, 70, 71, 137, 144, 158, 165}
13	{21, 24, 27, 86, 87, 88, 89, 90, 91, 92, 93, 106, 109, 110, 111, 113, 114, 116, 117, 119, 120}
14	{28, 29, 31, 32, 152, 173, 179, 184, 193, 198, 207, 211, 218, 222}
15	{37, 40, 42, 49, 52, 54, 112, 115, 118, 121}
16	{30, 33, 189, 203, 215, 226}
17	{45, 57, 230, 231, 234, 235, 241, 242, 245, 246, 252, 253, 256, 257}
18	{143, 149, 151, 164, 170, 172, 232, 236, 243, 247, 254, 258}
19	{238, 249, 260}
20	{157, 178, 239, 250, 261, 263, 264, 267, 268, 274, 275, 278, 279}
21	{265, 269, 276, 280}
22	{271, 282}
23	{272, 283}

Appendix 5_Length of paths_From element 7 to element 19_Positive paths

Length	Path number
9	{3, 4, 5, 8, 9, 12, 13, 16, 17}
11	{7, 11, 15, 18}
13	{35, 36, 39, 41, 47, 48, 51, 53, 138, 139, 145, 146, 159, 160, 166, 167}
14	{72, 73, 74, 75, 76, 77, 140, 147, 161, 168}
15	{43, 44, 55, 56, 59, 61, 64, 66, 94, 95, 96, 97, 98, 99, 122, 123, 125, 126, 128, 129, 153, 174, 180, 181, 185, 186, 194, 195, 199, 200, 208, 209, 212, 213, 219, 220, 223, 224}
16	{141, 142, 148, 150, 154, 162, 163, 169, 171, 175, 182, 187, 196, 201, 210, 214, 221, 225, 229, 233, 240, 244, 251, 255}
17	{62, 67, 78, 79, 80, 81, 124, 127, 130, 190, 204, 216, 227}
18	{100, 101, 102, 103, 131, 132, 134, 135, 155, 156, 176, 177, 183, 188, 191, 197, 202, 205, 217, 228, 237, 248, 259}
19	{262, 266, 273, 277}
20	{133, 136, 192, 206}
21	{270, 281}

Appendix 5_Length of paths_From element 7 to element 27_Negative paths

Length	Path number
14	{79}
15	{80}
16	{35, 39, 43, 49, 51, 55, 57, 61, 63}
17	{36, 40, 44, 50, 52, 56, 58, 62, 64, 81, 83}
18	{47, 53, 59, 65, 82, 84}
19	{48, 54, 60, 66, 67, 69, 73, 75}
20	{68, 70, 74, 76, 85}
21	{71, 77, 86}
22	{72, 78}

Appendix 5_Length of paths_From element 7 to element 27_Positive paths

Length	Path number
12	{1, 3, 7, 9, 31}
13	{2, 4, 8, 10, 32}
14	{5, 11, 13, 15, 19, 21, 25, 27, 37, 41}
15	{6, 12, 14, 16, 20, 22, 26, 28, 33, 38, 42}
16	{17, 23, 29, 34, 45}
17	{18, 24, 30, 46}
18	{87}
19	{88}
21	{89}
22	{90}

Appendix 5_Length of paths_From element 8 to element 3_Negative paths

Length	Path number
13	{5}
16	{6}

Appendix 5_Length of paths_From element 8 to element 3_Positive paths

Length	Path number
3	{1, 2}
5	{3}
11	{4}

Appendix 5_Length of paths_From element 8 to element 19_Negative paths

Length	Path number
8	{3, 4, 5, 8, 9, 12, 13, 16, 17}
10	{7, 11, 15, 18}
12	{35, 36, 39, 41, 47, 48, 51, 53, 138, 139, 145, 146, 159, 160, 166, 167}
13	{72, 73, 74, 75, 76, 77, 140, 147, 161, 168}
14	{43, 44, 55, 56, 59, 61, 64, 66, 94, 95, 96, 97, 98, 99, 122, 123, 125, 126, 128, 129, 153, 174, 180, 181, 185, 186, 194, 195, 199, 200, 208, 209, 212, 213, 219, 220, 223, 224}
15	{141, 142, 148, 150, 154, 162, 163, 169, 171, 175, 182, 187, 196, 201, 210, 214, 221, 225, 229, 233, 240, 244, 251, 255}
16	{62, 67, 78, 79, 80, 81, 124, 127, 130, 190, 204, 216, 227}
17	{100, 101, 102, 103, 131, 132, 134, 135, 155, 156, 176, 177, 183, 188, 191, 197, 202, 205, 217, 228, 237, 248, 259}
18	{262, 266, 273, 277}
19	{133, 136, 192, 206}
20	{270, 281}

Appendix 5_Length of paths_From element 8 to element 19_Positive paths

Length	Path number
4	{1}
7	{2}
9	{34, 38, 46, 50}
10	{6, 10, 14, 19, 20, 22, 23, 25, 26, 82, 83, 84, 85, 104, 105, 107, 108}
11	{58, 60, 63, 65, 68, 69, 70, 71, 137, 144, 158, 165}
12	{21, 24, 27, 86, 87, 88, 89, 90, 91, 92, 93, 106, 109, 110, 111, 113, 114, 116, 117, 119, 120}
13	{28, 29, 31, 32, 152, 173, 179, 184, 193, 198, 207, 211, 218, 222}
14	{37, 40, 42, 49, 52, 54, 112, 115, 118, 121}
15	{30, 33, 189, 203, 215, 226}
16	{45, 57, 230, 231, 234, 235, 241, 242, 245, 246, 252, 253, 256, 257}
17	{143, 149, 151, 164, 170, 172, 232, 236, 243, 247, 254, 258}
18	{238, 249, 260}
19	{157, 178, 239, 250, 261, 263, 264, 267, 268, 274, 275, 278, 279}
20	{265, 269, 276, 280}
21	{271, 282}
22	{272, 283}

Appendix 5_Length of paths_From element 8 to element 27_Negative paths

Length	Path number
11	{1, 3, 7, 9, 31}
12	{2, 4, 8, 10, 32}
13	{5, 11, 13, 15, 19, 21, 25, 27, 37, 41}
14	{6, 12, 14, 16, 20, 22, 26, 28, 33, 38, 42}
15	{17, 23, 29, 34, 45}
16	{18, 24, 30, 46}
17	{87}
18	{88}
20	{89}
21	{90}

Appendix 5_Length of paths_From element 8 to element 27_Positive paths

Length	Path number
13	{79}
14	{80}
15	{35, 39, 43, 49, 51, 55, 57, 61, 63}
16	{36, 40, 44, 50, 52, 56, 58, 62, 64, 81, 83}
17	{47, 53, 59, 65, 82, 84}
18	{48, 54, 60, 66, 67, 69, 73, 75}
19	{68, 70, 74, 76, 85}
20	{71, 77, 86}
21	{72, 78}

Appendix 5_Length of paths_From element 9 to element 3_Negative paths

Length	Path number
5	{1, 2}
6	{4}
7	{3}
8	{5}
9	{13, 19, 36, 37}
10	{9, 47, 53, 81, 102}
11	{17, 18, 22, 29, 39, 40, 42, 43, 44}
12	{12, 51, 52, 56, 63, 72, 96, 144}
13	{24, 25, 27, 28, 69, 75, 94, 97, 98, 109}
14	{32, 58, 59, 61, 62, 73, 86, 87, 88, 107, 108, 116, 123, 130}
15	{66, 99, 110, 124, 125, 131, 132, 151}
16	{149, 150}
17	{79, 80, 92, 93, 120, 121, 126, 133, 139}
18	{115, 137, 138}
19	{156, 157}

Appendix 5_Length of paths_From element 9 to element 3_Positive paths

Length	Path number
6	{7}
7	{35}
8	{8, 10}
9	{16, 38, 41} 10
{6,	11, 50, 95}
11	{14, 15, 20, 21, 23, 26}
12	{48, 49, 54, 55, 57, 60, 82, 103, 122, 129}
13	{30, 31, 45, 46, 83, 84, 104, 105}
14	{64, 65, 100, 101, 112, 113, 145}
15	{70, 71, 76, 77, 78, 85, 91, 106, 119, 142, 146, 147}
16	{33, 34, 74, 89, 90, 114, 117, 118, 127, 128, 134, 135, 136}
17	{67, 68, 111, 148, 152}
18	{143, 153, 154}
19	{140, 141}
20	{155}

Appendix 5_Length of paths_From element 9 to element 19_Negative paths

Length	Path number
6	{1}
7	{14, 29}
8	{73, 78}
9	{2, 106, 111, 143, 153}
10	{205, 238}
11	{39, 43, 51, 55}
12	{7, 11, 17, 23, 24, 26, 27, 30, 31, 74, 75, 98, 99, 100, 101, 131, 132, 134, 135}
13	{63, 65, 68, 70, 76, 77, 85, 86, 107, 108, 144, 146, 173, 176, 181, 184, 292, 301}
14	{25, 28, 32, 102, 103, 104, 105, 109, 110, 118, 119, 133, 136, 137, 138, 140, 141, 150, 151, 154, 155, 207, 216, 221, 240}
15	{33, 34, 36, 37, 145, 147, 179, 187, 189, 192, 197, 200, 230, 233, 267, 270}
16	{42, 45, 47, 54, 57, 59, 81, 82, 83, 84, 139, 142, 152, 156, 219, 224, 298}
17	{35, 38, 114, 115, 116, 117, 195, 203, 210, 211, 236, 243, 244, 250, 251, 253, 254, 273, 294}
18	{50, 62, 214, 247, 255, 256, 259, 260, 276, 277, 279, 280, 284, 285, 287, 288, 303, 304, 306, 307}
19	{227, 229, 295, 299}
20	{258, 262, 282, 290, 309}
21	{311, 312, 314, 315, 319, 320, 322, 323}
23	{317, 325}

Appendix 5_Length of paths_From element 9 to element 19_Positive paths

Length	Path number
3	{4}
5	{13, 19}
10	{3, 5, 6, 9, 10, 15, 16, 20, 21, 91}
11	{124, 163, 206, 215, 239, 248} 12
{8,	12, 18, 22, 291}
14	{40, 41, 44, 46, 52, 53, 56, 58, 79, 80, 174, 175, 177, 178, 182, 183, 185, 186, 212, 245}
15	{87, 88, 89, 90, 92, 93, 112, 113, 208, 217, 218, 222, 223, 241, 249, 252}
16	{48, 49, 60, 61, 64, 66, 69, 71, 120, 121, 122, 123, 125, 126, 157, 158, 160, 161, 164, 165, 180, 188, 190, 191, 193, 194, 198, 199, 201, 202, 231, 232, 234, 235, 268, 269, 271, 272, 293}
17	{148, 149, 209, 213, 220, 225, 242, 246, 275, 278, 283, 286, 302, 305}
18	{67, 72, 94, 95, 96, 97, 159, 162, 166, 196, 204, 226, 228, 237, 274}
19	{127, 128, 129, 130, 167, 168, 170, 171, 263, 264, 265, 266, 281, 289, 296, 297, 308}
20	{257, 261, 300, 310, 313, 318, 321}
21	{169, 172}
22	{316, 324}

Appendix 5_Length of paths_From element 9 to element 27_Negative paths

Length	Path number
12	{28, 47}
15	{57}
16	{29, 31}
17	{26, 36, 38, 41, 42, 44, 45, 48, 49, 63, 64, 69, 70}
18	{19, 20, 30, 32, 58, 59}
19	{40, 43, 46, 50, 75, 76}
20	{51, 52, 54, 55}
21	{60, 83, 84, 85, 86}
22	{53, 56}

Appendix 5_Length of paths_From element 9 to element 27_Positive paths

Length	Path number
2	{1}
10	{14, 27}
13	{2, 3, 5, 6, 24}
14	{15, 17}
15	{4, 7, 8, 9, 11, 12, 21, 22, 35, 37}
16	{16, 18, 25}
17	{10, 13, 23, 39}
19	{61, 65, 66, 67, 68, 71, 72, 73, 74, 81, 82}
20	{33, 34}
21	{77, 78, 79, 80}
22	{62}

Appendix 5_Length of paths_From element 10 to element 3_Negative paths

Length	Path number
5	{1}
7	{2}
8	{7, 10}
9	{29, 32, 54, 73}
10	{13, 21, 22, 24, 25, 26}
11	{6, 35, 45}
12	{15, 16, 18, 19, 42, 48, 83}
13	{37, 38, 40, 41, 46, 59, 60, 61, 62, 64, 78, 79, 80, 81, 93, 103, 113}
14	{84, 104, 105, 114, 115}
15	{63, 82}
16	{52, 53, 68, 69, 97, 98, 106, 116, 125}
17	{71, 72, 89, 100, 101, 123, 124, 128}
18	{92}

Appendix 5_Length of paths_From element 10 to element 3_Positive paths

Length	Path number
7	{4}
8	{20, 23}
9	{3, 5}
10	{8, 9, 11, 12, 14, 17}
11	{30, 31, 33, 34, 36, 39, 55, 74, 102, 112}
12	{27, 28, 56, 57, 75, 76}
13	{86, 87}
14	{43, 44, 49, 50, 51, 58, 67, 77, 90, 96}
15	{47, 65, 66, 70, 88, 94, 95, 99, 107, 108, 109, 110, 117, 118, 119, 120, 122}
16	{85, 91}
17	{111, 121}
18	{126, 127}
19	{129, 130}

Appendix 5_Length of paths_From element 10 to element 19_Negative paths

Length	Path number
6	{2, 4}
7	{5, 8}
8	{16, 19, 27, 34}
9	{36, 71}
11	{6, 7}
12	{17, 18, 28, 30, 113, 125}
13	{38, 51, 58, 73, 126}
14	{29, 31, 46, 81}
15	{11, 12, 13, 14, 55, 62, 119}
16	{22, 23, 24, 25, 41, 42, 76, 77, 87, 88, 90, 91, 115}
17	{45, 47, 80, 82, 92, 93, 96, 97}
18	{66, 69, 116, 120}
19	{67, 70, 95, 99}
20	{106, 110, 124}

Appendix 5_Length of paths_From element 10 to element 19_Positive paths

Length	Path number
4	{1, 3}
9	{15}
10	{26, 35, 37, 49, 72, 84}
11	{50, 85, 112}
13	{9, 10, 43, 78}
14	{20, 21, 39, 52, 53, 59, 60, 74, 86, 89}
15	{54, 61, 114}
16	{32, 33, 40, 44, 56, 63, 75, 79, 122}
17	{57, 64, 65, 68}
18	{48, 83, 100, 101, 102, 103, 104, 105, 108, 109, 117, 118}
19	{94, 98, 121, 123}
20	{107, 111}

Appendix 5_Length of paths_From element 10 to element 27_Negative paths

Length	Path number
11	{17, 31}
12	{18, 32}
15	{19, 23}
16	{20, 24, 33, 35, 45, 47}
17	{11, 13, 21, 25, 34, 36, 46, 48}
18	{12, 14, 22, 26, 57, 59}
19	{58, 60}
20	{73, 75, 77, 79}
21	{74, 76, 78, 80}

Appendix 5_Length of paths_From element 10 to element 27_Positive paths

Length	Path number
9	{1, 15}
10	{2, 16}
13	{3, 7}
14	{4, 8}
15	{5, 9}
16	{6, 10}
18	{37, 39, 41, 43, 49, 51, 53, 55, 69, 71}
19	{27, 29, 38, 40, 42, 44, 50, 52, 54, 56, 70, 72}
20	{28, 30, 61, 63, 65, 67}
21	{62, 64, 66, 68}

Appendix 5_Length of paths_From element 11 to element 3_Negative paths

Length	Path number
7	{13}
8	{3}
9	{5, 6, 7}
10	{23, 24, 28, 44, 65}
11	{17, 18, 45, 46}
12	{10}
13	{25, 31, 35, 36, 37, 47, 56, 84}
14	{20, 21, 54, 55, 59, 70, 71, 72, 73, 75}
16	{40, 62, 74}
17	{79, 80, 89, 90, 91, 92, 94}
18	{82, 83}
19	{93}
20	{98, 99}
21	{101, 102}

Appendix 5_Length of paths_From element 11 to element 3_Positive paths

Length	Path number
4	{1}
6	{2}
7	{4}
8	{22, 43}
9	{14, 15, 16}
11	{8, 9, 34}
12	{19, 29, 30, 48, 49, 50, 51, 53, 66}
13	{67, 68}
14	{11, 12, 52}
15	{26, 27, 32, 33, 38, 39, 57, 58, 69, 78, 85}
16	{60, 61, 76, 77, 81, 86, 87}
18	{41, 42, 63, 64, 88, 97}
19	{95, 96, 100}

Appendix 5_Length of paths_From element 11 to element 19_Negative paths

Length	Path number
3	{1}
8	{21}
9	{4, 9, 30, 40, 46, 58}
10	{59, 97}
11	{5, 23}
12	{10, 32, 44, 52, 67}
13	{14, 17, 25, 48, 60, 72, 73, 81, 82, 122}
14	{74, 83, 99}
15	{15, 18, 38, 39, 49, 53, 77, 86, 107, 113, 114}
16	{75, 78, 84, 87, 89, 93, 115}
17	{43, 57, 65, 66, 68, 69, 102, 103, 117, 124}
18	{79, 88, 106, 108, 118, 119, 132}
19	{70}
20	{127, 128}
21	{131, 133}

Appendix 5_Length of paths_From element 11 to element 19_Positive paths

Length	Path number
5	{2, 3}
6	{8}
7	{24, 33}
8	{7, 45}
10	{13, 16}
11	{28, 29, 34, 36, 98, 110}
12	{22, 47, 71, 80, 111}
13	{6, 31, 35, 37, 41, 55}
14	{11, 12, 76, 85, 104, 112, 123, 135}
15	{26, 27, 42, 50, 51, 61, 100, 136}
16	{54, 56, 62, 63, 116}
17	{19, 20, 90, 94, 101, 105, 129}
18	{64, 91, 95, 125}
19	{109, 120}
20	{92, 96, 121, 126, 130}
22	{134}

Appendix 5_Length of paths_From element 11 to element 27_Negative paths

Length	Path number
8	{1}
9	{2}
12	{3, 7}
13	{4, 8}
14	{5, 9, 17}
15	{6, 10, 18}
16	{19}
17	{20, 29, 31, 33, 35, 43, 45}
18	{30, 32, 34, 36, 44, 46}
19	{39, 41}
20	{40, 42, 55, 57}
21	{56, 58}

Appendix 5_Length of paths_From element 11 to element 27_Positive paths

Length	Path number
10	{15}
11	{16}
13	{23}
14	{24}
15	{25, 27}
16	{11, 13, 26, 28}
17	{12, 14, 37}
18	{21, 38}
19	{22, 47, 49, 51, 53}
20	{48, 50, 52, 54}
22	{59, 61, 63, 65}
23	{60, 62, 64, 66}

Appendix 5_Length of paths_From element 12 to element 3_Negative paths

Length	Path number
6	{13}
7	{3}
8	{5, 6, 7}
9	{23, 24, 28, 44, 65}
10	{17, 18, 45, 46}
11	{10}
12	{25, 31, 35, 36, 37, 47, 56, 84}
13	{20, 21, 54, 55, 59, 70, 71, 72, 73, 75}
15	{40, 62, 74}
16	{79, 80, 89, 90, 91, 92, 94}
17	{82, 83}
18	{93}
19	{98, 99}
20	{101, 102}

Appendix 5_Length of paths_From element 12 to element 3_Positive paths

Length	Path number
3	{1}
5	{2}
6	{4}
7	{22, 43}
8	{14, 15, 16}
10	{8, 9, 34}
11	{19, 29, 30, 48, 49, 50, 51, 53, 66}
12	{67, 68}
13	{11, 12, 52}
14	{26, 27, 32, 33, 38, 39, 57, 58, 69, 78, 85}
15	{60, 61, 76, 77, 81, 86, 87}
17	{41, 42, 63, 64, 88, 97}
18	{95, 96, 100}

Appendix 5_Length of paths_From element 12 to element 19_Negative paths

Length	Path number
2	{1}
7	{21}
8	{4, 9, 30, 40, 46, 58}
9	{59, 97}
10	{5, 23}
11	{10, 32, 44, 52, 67}
12	{14, 17, 25, 48, 60, 72, 73, 81, 82, 122}
13	{74, 83, 99}
14	{15, 18, 38, 39, 49, 53, 77, 86, 107, 113, 114}
15	{75, 78, 84, 87, 89, 93, 115}
16	{43, 57, 65, 66, 68, 69, 102, 103, 117, 124}
17	{79, 88, 106, 108, 118, 119, 132}
18	{70}
19	{127, 128}
20	{131, 133}

Appendix 5_Length of paths_From element 12 to element 19_Positive paths

Length	Path number
4	{2, 3}
5	{8}
6	{24, 33}
7	{7, 45} 9
	{13, 16}
10	{28, 29, 34, 36, 98, 110}
11	{22, 47, 71, 80, 111}
12	{6, 31, 35, 37, 41, 55}
13	{11, 12, 76, 85, 104, 112, 123, 135}
14	{26, 27, 42, 50, 51, 61, 100, 136}
15	{54, 56, 62, 63, 116}
16	{19, 20, 90, 94, 101, 105, 129}
17	{64, 91, 95, 125}
18	{109, 120}
19	{92, 96, 121, 126, 130}
21	{134}

Appendix 5_Length of paths_From element 12 to element 27_Negative paths

Length	Path number
7	{1}
8	{2}
11	{3, 7}
12	{4, 8}
13	{5, 9, 17}
14	{6, 10, 18}
15	{19}
16	{20, 29, 31, 33, 35, 43, 45}
17	{30, 32, 34, 36, 44, 46}
18	{39, 41}
19	{40, 42, 55, 57}
20	{56, 58}

Appendix 5_Length of paths_From element 12 to element 27_Positive paths

Length	Path number
9	{15}
10	{16}
12	{23}
13	{24}
14	{25, 27}
15	{11, 13, 26, 28}
16	{12, 14, 37}
17	{21, 38}
18	{22, 47, 49, 51, 53}
19	{48, 50, 52, 54}
21	{59, 61, 63, 65}
22	{60, 62, 64, 66}

Appendix 5_Length of paths_From element 13 to element 3_Negative paths

Length	Path number
8	{4}
9	{20, 23}
10	{3, 5}
11	{8, 9, 11, 12, 14, 17}
12	{30, 31, 33, 34, 36, 39, 55, 74, 102, 112}
13	{27, 28, 56, 57, 75, 76}
14	{86, 87}
15	{43, 44, 49, 50, 51, 58, 67, 77, 90, 96}
16	{47, 65, 66, 70, 88, 94, 95, 99, 107, 108, 109, 110, 117, 118, 119, 120, 122}
17	{85, 91}
18	{111, 121}
19	{126, 127}
20	{129, 130}

Appendix 5_Length of paths_From element 13 to element 3_Positive paths

Length	Path number
6	{1}
8	{2}
9	{7, 10}
10	{29, 32, 54, 73}
11	{13, 21, 22, 24, 25, 26}
12	{6, 35, 45}
13	{15, 16, 18, 19, 42, 48, 83}
14	{37, 38, 40, 41, 46, 59, 60, 61, 62, 64, 78, 79, 80, 81, 93, 103, 113}
15	{84, 104, 105, 114, 115}
16	{63, 82}
17	{52, 53, 68, 69, 97, 98, 106, 116, 125}
18	{71, 72, 89, 100, 101, 123, 124, 128}
19	{92}

Appendix 5_Length of paths_From element 13 to element 19_Negative paths

Length	Path number
5	{1, 3}
10	{15}
11	{26, 35, 37, 49, 72, 84}
12	{50, 85, 112}
14	{9, 10, 43, 78}
15	{20, 21, 39, 52, 53, 59, 60, 74, 86, 89}
16	{54, 61, 114}
17	{32, 33, 40, 44, 56, 63, 75, 79, 122}
18	{57, 64, 65, 68}
19	{48, 83, 100, 101, 102, 103, 104, 105, 108, 109, 117, 118}
20	{94, 98, 121, 123}
21	{107, 111}

Appendix 5_Length of paths_From element 13 to element 19_Positive paths

Length	Path number
7	{2, 4}
8	{5, 8}
9	{16, 19, 27, 34}
10	{36, 71}
12	{6, 7}
13	{17, 18, 28, 30, 113, 125}
14	{38, 51, 58, 73, 126}
15	{29, 31, 46, 81}
16	{11, 12, 13, 14, 55, 62, 119}
17	{22, 23, 24, 25, 41, 42, 76, 77, 87, 88, 90, 91, 115}
18	{45, 47, 80, 82, 92, 93, 96, 97}
19	{66, 69, 116, 120}
20	{67, 70, 95, 99}
21	{106, 110, 124}

Appendix 5_Length of paths_From element 13 to element 27_Negative paths

Length	Path number
10	{1, 15}
11	{2, 16}
14	{3, 7}
15	{4, 8}
16	{5, 9}
17	{6, 10}
19	{37, 39, 41, 43, 49, 51, 53, 55, 69, 71}
20	{27, 29, 38, 40, 42, 44, 50, 52, 54, 56, 70, 72}
21	{28, 30, 61, 63, 65, 67}
22	{62, 64, 66, 68}

Appendix 5_Length of paths_From element 13 to element 27_Positive paths

Length	Path number
12	{17, 31}
13	{18, 32}
16	{19, 23}
17	{20, 24, 33, 35, 45, 47}
18	{11, 13, 21, 25, 34, 36, 46, 48}
19	{12, 14, 22, 26, 57, 59}
20	{58, 60}
21	{73, 75, 77, 79}
22	{74, 76, 78, 80}

Appendix 5_Length of paths_From element 14 to element 3_Negative paths

Length	Path number
7	{7}
8	{26, 48}
9	{13, 21, 22}
10	{6, 10, 29, 39}
11	{18, 19, 42, 61}
12	{11, 23, 37, 38, 40, 53, 54, 55, 56, 71, 103}
13	{3, 58, 62, 104, 105}
14	{15, 16, 57}
15	{31, 32, 34, 35, 59, 75, 76, 84, 106}
16	{67, 78, 79, 85, 86}
17	{70}
18	{46, 47, 81, 82, 87, 96}
19	{94, 95, 99}

Appendix 5_Length of paths_From element 14 to element 3_Positive paths

Length	Path number
6	{4}
7	{20}
8	{5}
9	{1, 8, 9, 17}
10	{27, 28, 36, 49, 102}
11	{2, 50, 51}
12	{14, 64, 65}
13	{30, 33, 43, 44, 52, 68, 74, 83}
14	{12, 24, 25, 41, 66, 72, 73, 77, 107, 108, 109, 110}
15	{63, 69}
16	{45, 80, 111}
17	{60, 88, 89, 90, 91, 93}
19	{92}
20	{97, 98}
21	{100, 101}

Appendix 5_Length of paths_From element 14 to element 19_Negative paths

Length	Path number
6	{4}
7	{19, 32}
8	{2, 40}
11	{12}
12	{42}
13	{50}
14	{7, 8, 9, 10, 14, 15, 91, 97, 109}
15	{22, 23, 24, 25, 27, 28, 45, 46, 56, 57, 59, 60, 82, 83, 110}
16	{49, 51, 61, 62, 65, 66, 84, 85}
17	{103}
18	{64, 68, 87, 99, 112, 113, 119, 120}
19	{75, 79, 94, 114, 121}
20	{38, 39, 100, 104, 116, 123}
21	{117, 124, 125, 128}
22	{108}

Appendix 5_Length of paths_From element 14 to element 19_Positive paths

Length	Path number
3	{1}
9	{11, 41, 53}
10	{3, 54}
11	{16}
12	{5, 6, 13, 29, 33, 47, 90}
13	{20, 21, 26, 43, 55, 58, 81, 96}
15	{17, 18, 44, 48}
16	{30, 31, 34, 36}
17	{52, 69, 70, 71, 72, 73, 74, 77, 78, 88, 89, 92, 93, 98, 111, 118}
18	{35, 37, 63, 67, 86, 106}
19	{76, 80, 95, 115, 122}
20	{101, 102}
21	{105, 107}
22	{126, 129}
23	{127, 130}

Appendix 5_Length of paths_From element 14 to element 27_Negative paths

Length	Path number
10	{17}
11	{18}
13	{3}
14	{4, 19, 23}
15	{20, 24, 31, 33}
16	{21, 25, 32, 34}
17	{5, 9, 22, 26, 43, 45, 55}
18	{6, 10, 44, 46, 56}
19	{7, 11}
20	{8, 12}
22	{65, 67, 69, 71}
23	{66, 68, 70, 72}

Appendix 5_Length of paths_From element 14 to element 27_Positive paths

Length	Path number
8	{1}
9	{2}
17	{35, 37, 39, 41}
18	{27, 29, 36, 38, 40, 42}
19	{28, 30, 47, 49, 51, 53, 57, 59}
20	{48, 50, 52, 54, 58, 60, 61, 63}
21	{13, 15, 62, 64}
22	{14, 16}

Appendix 5_Length of paths_From element 15 to element 3_Negative paths

Length	Path number
4	{1}
5	{11, 30}
6	{7}
7	{4, 14, 24}
8	{27, 43}
9	{5, 25, 35, 36, 37, 38, 56}
10	{40, 44}
11	{39}
12	{16, 17, 19, 20, 21, 41, 60, 61}
13	{10, 49, 63, 64}
14	{52}
15	{66, 67, 69, 70, 71}
16	{55}

Appendix 5_Length of paths_From element 15 to element 3_Positive paths

Length	Path number
6	{2, 3}
7	{12, 13, 31}
8	{32, 33}
9	{8, 46, 47}
10	{15, 18, 28, 29, 34, 50, 59}
11	{6, 9, 26, 48, 57, 58, 62}
12	{45, 51, 53}
13	{65, 68}
14	{22, 23, 42, 54}
17	{72, 73}

Appendix 5_Length of paths_From element 15 to element 19_Negative paths

Length	Path number
3	{1}
4	{33, 61}
5	{62}
8	{9, 23}
9	{64}
10	{72}
11	{4, 5, 6, 7, 11, 12, 15, 16, 17, 18, 24, 113, 156}
12	{36, 37, 38, 39, 41, 42, 44, 45, 46, 47, 52, 67, 68, 78, 79, 81, 82, 104, 105, 119, 129, 131, 149}
13	{71, 73, 83, 84, 87, 88, 106, 107, 120, 121}
14	{27, 28}
15	{55, 56, 86, 90, 109, 122, 160, 162}
16	{97, 101, 116, 139, 140, 141, 142, 143, 144, 146, 147, 154, 155, 157, 158}
18	{145, 148, 159}
19	{170, 171, 172, 173, 174, 175, 177, 178}
21	{176, 179}

Appendix 5_Length of paths_From element 15 to element 19_Positive paths

Length	Path number
6	{8, 13, 63, 75}
7	{76}
9	{2, 3, 10, 14, 69, 112, 125}
10	{34, 35, 40, 43, 65, 77, 80, 103, 118}
12	{66, 70}
13	{19, 20, 21, 22, 25, 26}
14	{48, 49, 50, 51, 53, 54, 74, 91, 92, 93, 94, 95, 96, 99, 100, 110, 111, 114, 115, 123, 124, 126, 127, 130, 132, 150}
15	{85, 89, 108, 133, 134, 136, 137, 151, 152}
16	{29, 30, 31, 32, 98, 102, 117, 128}
17	{57, 58, 59, 60, 135, 138, 153, 161, 163}
18	{164, 165, 167, 168}
20	{166, 169}

Appendix 5_Length of paths_From element 15 to element 27_Negative paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 15 to element 27_Positive paths

Length	Path number
5	{1}
6	{2}

Appendix 5_Length of paths_From element 16 to element 3_Negative paths

Length	Path number
7	{1}
9	{2}
10	{7, 10}
11	{29, 32, 54, 73}
12	{13, 21, 22, 24, 25, 26}
13	{6, 35, 45}
14	{15, 16, 18, 19, 42, 48, 83}
15	{37, 38, 40, 41, 46, 59, 60, 61, 62, 64, 78, 79, 80, 81, 93, 103, 113}
16	{84, 104, 105, 114, 115}
17	{63, 82}
18	{52, 53, 68, 69, 97, 98, 106, 116, 125}
19	{71, 72, 89, 100, 101, 123, 124, 128}
20	{92}

Appendix 5_Length of paths_From element 16 to element 3_Positive paths

Length	Path number
9	{4}
10	{20, 23}
11	{3, 5}
12	{8, 9, 11, 12, 14, 17}
13	{30, 31, 33, 34, 36, 39, 55, 74, 102, 112}
14	{27, 28, 56, 57, 75, 76}
15	{86, 87}
16	{43, 44, 49, 50, 51, 58, 67, 77, 90, 96}
17	{47, 65, 66, 70, 88, 94, 95, 99, 107, 108, 109, 110, 117, 118, 119, 120, 122}
18	{85, 91}
19	{111, 121}
20	{126, 127}
21	{129, 130}

Appendix 5_Length of paths_From element 16 to element 19_Negative paths

Length	Path number
8	{2, 4}
9	{5, 8}
10	{16, 19, 27, 34}
11	{36, 71}
13	{6, 7}
14	{17, 18, 28, 30, 113, 125}
15	{38, 51, 58, 73, 126}
16	{29, 31, 46, 81}
17	{11, 12, 13, 14, 55, 62, 119}
18	{22, 23, 24, 25, 41, 42, 76, 77, 87, 88, 90, 91, 115}
19	{45, 47, 80, 82, 92, 93, 96, 97}
20	{66, 69, 116, 120}
21	{67, 70, 95, 99}
22	{106, 110, 124}

Appendix 5_Length of paths_From element 16 to element 19_Positive paths

Length	Path number
6	{1, 3}
11	{15}
12	{26, 35, 37, 49, 72, 84}
13	{50, 85, 112}
15	{9, 10, 43, 78}
16	{20, 21, 39, 52, 53, 59, 60, 74, 86, 89}
17	{54, 61, 114}
18	{32, 33, 40, 44, 56, 63, 75, 79, 122}
19	{57, 64, 65, 68}
20	{48, 83, 100, 101, 102, 103, 104, 105, 108, 109, 117, 118}
21	{94, 98, 121, 123}
22	{107, 111}

Appendix 5_Length of paths_From element 16 to element 27_Negative paths

Length	Path number
13	{17, 31}
14	{18, 32}
17	{19, 23}
18	{20, 24, 33, 35, 45, 47}
19	{11, 13, 21, 25, 34, 36, 46, 48}
20	{12, 14, 22, 26, 57, 59}
21	{58, 60}
22	{73, 75, 77, 79}
23	{74, 76, 78, 80}

Appendix 5_Length of paths_From element 16 to element 27_Positive paths

Length	Path number
11	{1, 15}
12	{2, 16}
15	{3, 7}
16	{4, 8}
17	{5, 9}
18	{6, 10}
20	{37, 39, 41, 43, 49, 51, 53, 55, 69, 71}
21	{27, 29, 38, 40, 42, 44, 50, 52, 54, 56, 70, 72}
22	{28, 30, 61, 63, 65, 67}
23	{62, 64, 66, 68}

Appendix 5_Length of paths_From element 17 to element 3_Negative paths

Length	Path number
7	{2, 3}
8	{12, 13, 31}
9	{32, 33}
10	{8, 46, 47}
11	{15, 18, 28, 29, 34, 50, 59}
12	{6, 9, 26, 48, 57, 58, 62}
13	{45, 51, 53}
14	{65, 68}
15	{22, 23, 42, 54}
18	{72, 73}

Appendix 5_Length of paths_From element 17 to element 3_Positive paths

Length	Path number
5	{1}
6	{11, 30}
7	{7}
8	{4, 14, 24}
9	{27, 43}
10	{5, 25, 35, 36, 37, 38, 56}
11	{40, 44}
12	{39}
13	{16, 17, 19, 20, 21, 41, 60, 61}
14	{10, 49, 63, 64}
15	{52}
16	{66, 67, 69, 70, 71}
17	{55}

Appendix 5_Length of paths_From element 17 to element 19_Negative paths

Length	Path number
7	{8, 13, 63, 75}
8	{76}
10	{2, 3, 10, 14, 69, 112, 125}
11	{34, 35, 40, 43, 65, 77, 80, 103, 118}
13	{66, 70}
14	{19, 20, 21, 22, 25, 26}
15	{48, 49, 50, 51, 53, 54, 74, 91, 92, 93, 94, 95, 96, 99, 100, 110, 111, 114, 115, 123, 124, 126, 127, 130, 132, 150}
16	{85, 89, 108, 133, 134, 136, 137, 151, 152}
17	{29, 30, 31, 32, 98, 102, 117, 128}
18	{57, 58, 59, 60, 135, 138, 153, 161, 163}
19	{164, 165, 167, 168}
21	{166, 169}

Appendix 5_Length of paths_From element 17 to element 19_Positive paths

Length	Path number
4	{1}
5	{33, 61}
6	{62}
9	{9, 23}
10	{64}
11	{72}
12	{4, 5, 6, 7, 11, 12, 15, 16, 17, 18, 24, 113, 156}
13	{36, 37, 38, 39, 41, 42, 44, 45, 46, 47, 52, 67, 68, 78, 79, 81, 82, 104, 105, 119, 129, 131, 149}
14	{71, 73, 83, 84, 87, 88, 106, 107, 120, 121}
15	{27, 28}
16	{55, 56, 86, 90, 109, 122, 160, 162}
17	{97, 101, 116, 139, 140, 141, 142, 143, 144, 146, 147, 154, 155, 157, 158}
19	{145, 148, 159}
20	{170, 171, 172, 173, 174, 175, 177, 178}
22	{176, 179}

Appendix 5_Length of paths_From element 17 to element 27_Negative paths

Length	Path number
6	{1}
7	{2}

Appendix 5_Length of paths_From element 17 to element 27_Positive paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 18 to element 3_Negative paths

Length	Path number
6	{7}
7	{26, 48}
8	{13, 21, 22}
9	{6, 10, 29, 39}
10	{18, 19, 42, 61}
11	{11, 23, 37, 38, 40, 53, 54, 55, 56, 71, 103}
12	{3, 58, 62, 104, 105}
13	{15, 16, 57}
14	{31, 32, 34, 35, 59, 75, 76, 84, 106}
15	{67, 78, 79, 85, 86}
16	{70}
17	{46, 47, 81, 82, 87, 96}
18	{94, 95, 99}

Appendix 5_Length of paths_From element 18 to element 3_Positive paths

Length	Path number
5	{4}
6	{20}
7	{5}
8	{1, 8, 9, 17}
9	{27, 28, 36, 49, 102}
10	{2, 50, 51}
11	{14, 64, 65}
12	{30, 33, 43, 44, 52, 68, 74, 83}
13	{12, 24, 25, 41, 66, 72, 73, 77, 107, 108, 109, 110}
14	{63, 69}
15	{45, 80, 111}
16	{60, 88, 89, 90, 91, 93}
18	{92}
19	{97, 98}
20	{100, 101}

Appendix 5_Length of paths_From element 18 to element 19_Negative paths

Length	Path number
5	{4}
6	{19, 32}
7	{2, 40}
10	{12}
11	{42}
12	{50}
13	{7, 8, 9, 10, 14, 15, 91, 97, 109}
14	{22, 23, 24, 25, 27, 28, 45, 46, 56, 57, 59, 60, 82, 83, 110}
15	{49, 51, 61, 62, 65, 66, 84, 85}
16	{103}
17	{64, 68, 87, 99, 112, 113, 119, 120}
18	{75, 79, 94, 114, 121}
19	{38, 39, 100, 104, 116, 123}
20	{117, 124, 125, 128}
21	{108}

Appendix 5_Length of paths_From element 18 to element 19_Positive paths

Length	Path number
2	{1}
8	{11, 41, 53}
9	{3, 54}
10	{16}
11	{5, 6, 13, 29, 33, 47, 90}
12	{20, 21, 26, 43, 55, 58, 81, 96}
14	{17, 18, 44, 48}
15	{30, 31, 34, 36}
16	{52, 69, 70, 71, 72, 73, 74, 77, 78, 88, 89, 92, 93, 98, 111, 118}
17	{35, 37, 63, 67, 86, 106}
18	{76, 80, 95, 115, 122}
19	{101, 102}
20	{105, 107}
21	{126, 129}
22	{127, 130}

Appendix 5_Length of paths_From element 18 to element 27_Negative paths

Length	Path number
9	{17}
10	{18}
12	{3}
13	{4, 19, 23}
14	{20, 24, 31, 33}
15	{21, 25, 32, 34}
16	{5, 9, 22, 26, 43, 45, 55}
17	{6, 10, 44, 46, 56}
18	{7, 11}
19	{8, 12}
21	{65, 67, 69, 71}
22	{66, 68, 70, 72}

Appendix 5_Length of paths_From element 18 to element 27_Positive paths

Length	Path number
7	{1}
8	{2}
16	{35, 37, 39, 41}
17	{27, 29, 36, 38, 40, 42}
18	{28, 30, 47, 49, 51, 53, 57, 59}
19	{48, 50, 52, 54, 58, 60, 61, 63}
20	{13, 15, 62, 64}
21	{14, 16}

Appendix 5_Length of paths_From element 19 to element 3_Negative paths

Length	Path number
7	{14, 15}
8	{3}
9	{5, 6, 7}
10	{17, 18, 19, 26, 35}
11	{27, 28}
12	{10}
13	{22, 29, 45}
14	{40, 41, 42, 43}
16	{44}
17	{50, 51, 52, 53}
19	{54}

Appendix 5_Length of paths_From element 19 to element 3_Positive paths

Length	Path number
4	{1}
5	{13}
6	{2}
7	{4}
8	{16, 25}
11	{8, 9}
12	{20, 21, 30, 31, 32, 33, 36}
13	{37, 38}
14	{11, 12, 34}
15	{23, 24, 39, 46}
16	{47, 48}
18	{49}

Appendix 5_Length of paths_From element 19 to element 27_Negative paths

Length	Path number
8	{1}
9	{2}
12	{3, 7}
13	{4, 8, 25, 27}
14	{5, 9, 17, 26, 28}
15	{6, 10, 18, 37, 39, 49, 55}
16	{19, 38, 40, 50, 56}
17	{20}
19	{65, 67, 69, 71, 75, 77}
20	{66, 68, 70, 72, 76, 78}
22	{83, 85, 87, 89}
23	{84, 86, 88, 90}

Appendix 5_Length of paths_From element 19 to element 27_Positive paths

Length	Path number
10	{15}
11	{16}
13	{23}
14	{24}
15	{29, 31, 33, 35}
16	{11, 13, 30, 32, 34, 36}
17	{12, 14, 41, 43, 45, 47, 51, 53, 57, 59, 61, 63, 73}
18	{21, 42, 44, 46, 48, 52, 54, 58, 60, 62, 64, 74}
19	{22}
20	{79, 81}
21	{80, 82}

Appendix 5_Length of paths_From element 20 to element 3 _Negative paths

Length	Path number
4	{1}
6	{3}
9	{12, 13, 30}
10	{10, 40, 41, 80}
11	{22, 23, 24, 81, 82}
12	{18, 53, 54, 58, 95, 96, 124, 145, 149}
13	{34, 35, 43, 46, 68, 69, 83, 99, 108, 125, 126}
14	{16, 19, 27, 66, 97, 106, 107, 111}
15	{55, 61, 71, 72, 73, 94, 100, 102, 127, 136, 168}
16	{37, 38, 114, 117, 134, 135, 139, 147, 154, 155, 156, 157, 159, 193}
17	{50, 51, 91, 103, 188}
18	{76, 142, 158}
19	{163, 164, 173, 174, 175, 176, 178, 194}
20	{121, 122, 166, 167, 191}
21	{177}
22	{182, 183}
23	{185, 186}

Appendix 5_Length of paths_From element 20 to element 3_Positive paths

Length	Path number
4	{2}
6	{4, 5, 8}
7	{11}
8	{6, 7, 9, 39, 79}
9	{17, 21}
10	{14, 42, 52, 64, 123}
11	{31, 32, 33, 67, 92}
12	{15, 65, 84, 85, 86, 87, 105}
13	{25, 26, 70, 89, 93}
14	{36, 59, 60, 88, 128, 129, 130, 131, 133, 148, 150, 187}
15	{44, 45, 47, 48, 49, 90, 109, 110, 146, 151, 152}
16	{20, 28, 29, 98, 112, 113, 132}
17	{56, 57, 62, 63, 74, 75, 101, 137, 138, 153, 162, 169, 190}
18	{115, 116, 118, 119, 120, 140, 141, 160, 161, 165, 170, 171, 189}
19	{104}
20	{77, 78, 143, 144, 172, 181}
21	{179, 180, 184, 192}

Appendix 5_Length of paths_From element 20 to element 19_Negative paths

Length	Path number
5	{1, 6}
9	{9, 14, 23, 50, 55, 190, 197}
10	{63, 97, 198}
11	{2, 17, 18, 25, 26, 30, 33, 37, 79, 118, 134, 146, 169, 266, 273}
12	{52, 56, 83, 89, 93, 193, 208, 221, 236, 274, 360}
13	{12, 20, 21, 27, 28, 31, 35, 39, 68, 70, 105, 109, 112, 124, 126, 130, 148, 151, 155, 162, 199, 214, 244, 247}
14	{45, 80, 100, 102, 142, 184, 248, 253, 269, 282, 286, 306, 333}
15	{66, 86, 121, 137, 139, 153, 157, 164, 174, 178, 192, 194, 275, 292, 295, 311, 314, 338, 341, 423}
16	{47, 61, 62, 103, 104, 245, 249, 251, 296, 298, 315, 316, 342, 343, 362, 384, 400}
17	{74, 75, 76, 107, 116, 117, 140, 141, 180, 181, 206, 207, 210, 211, 219, 220, 222, 223, 226, 260, 268, 270, 320, 321, 324, 325, 347, 348, 351, 352, 366, 371, 372, 381, 382, 397, 398}
18	{144, 186, 204, 227, 228, 242, 261, 293, 297, 312, 322, 326, 339, 349, 353, 373, 383, 399, 409, 413}
19	{88, 172, 176, 182, 183, 213, 224, 280, 281, 283, 284, 303, 328, 331, 355, 358, 375, 391, 407, 425, 437}
20	{229, 258, 262, 263, 304, 329, 332, 356, 359, 367, 376, 377, 392, 393, 408, 417, 420, 429, 434, 435}
21	{285, 387, 403, 436}
22	{188, 305, 444}
23	{430, 445, 446}
24	{440}

Appendix 5_Length of paths_From element 20 to element 19_Positive paths

Length	Path number
6	{49}
7	{3, 7, 29, 108, 145}
8	{78, 189}
9	{8, 13, 22, 120, 150}
10	{4, 44, 67, 265}
11	{5, 10, 11, 15, 16, 24, 34, 38, 51, 59, 119, 147}
12	{85, 90, 94, 191, 243}
13	{19, 40, 41, 64, 65, 125, 127, 131, 152, 156, 163, 195, 237, 238, 361, 368}
14	{46, 53, 54, 57, 58, 60, 91, 92, 95, 96, 98, 99, 101, 209, 232, 239, 267, 291, 310, 337, 369}
15	{32, 36, 42, 43, 69, 71, 72, 73, 84, 110, 111, 113, 114, 115, 128, 129, 132, 133, 135, 136, 138, 149, 158, 159, 165, 166, 170, 173, 177, 200, 201, 215, 225, 254, 271, 287, 288, 307, 308, 334, 335}
16	{81, 82, 196, 202, 203, 216, 217, 240, 241, 255, 259, 289, 309, 319, 323, 336, 346, 350, 364, 370, 380, 396, 424, 431}
17	{87, 106, 122, 123, 154, 160, 161, 167, 168, 171, 175, 179, 246, 276, 299, 317, 344, 385, 388, 401, 404, 432}
18	{48, 143, 185, 205, 218, 250, 252, 256, 257, 272, 277, 278, 290, 300, 302, 318, 327, 330, 345, 354, 357, 374, 389, 390, 405, 406}
19	{77, 212, 230, 231, 233, 234, 294, 313, 340, 363, 365, 410, 411, 414, 415, 427, 433}
20	{187, 279, 301, 386, 402, 412, 416, 438, 441}
21	{235, 378, 394, 418, 421, 442, 443}
22	{264, 379, 395, 419, 422, 426, 428}
23	{439}
24	{447}
25	{448}

Appendix 5_Length of paths_From element 20 to element 27_Negative paths

Length	Path number
8	{1}
9	{2}
10	{11}
11	{12}
12	{5}
13	{6}
14	{15, 23, 39, 49, 113}
15	{16, 24, 40, 50, 114}
16	{9, 27, 29, 47, 57, 61, 75, 81, 89}
17	{10, 28, 30, 41, 48, 58, 62, 76, 82, 90, 115}
18	{19, 31, 33, 42, 43, 55, 65, 69, 77, 85, 93, 116}
19	{20, 32, 34, 44, 56, 66, 70, 78, 86, 94, 105}
20	{106, 117}
21	{109, 118, 135, 137}
22	{110, 136, 138}
23	{119}
24	{120}

Appendix 5_Length of paths_From element 20 to element 27_Positive paths

Length	Path number
12	{3, 35, 73}
13	{4, 36, 74}
14	{7, 13, 21, 45}
15	{8, 14, 22, 46, 103}
16	{17, 25, 51, 53, 83, 91, 104, 121}
17	{18, 26, 52, 54, 84, 92, 122}
18	{37, 59, 63, 95, 97}
19	{38, 60, 64, 96, 98, 107, 123, 125, 133}
20	{67, 71, 79, 87, 99, 101, 108, 124, 126, 129, 134}
21	{68, 72, 80, 88, 100, 102, 130}
22	{127}
23	{111, 128, 131}
24	{112, 132}

Appendix 5_Length of paths_From element 21 to element 3_Negative paths

Length	Path number
3	{2}
7	{4}
13	{8}
14	{6}
16	{11}
17	{10}
20	{13}

Appendix 5_Length of paths_From element 21 to element 3_Positive paths

Length	Path number
3	{1}
5	{3}
11	{5}
15	{7}
16	{9}
19	{12}

Appendix 5_Length of paths_From element 21 to element 19_Negative paths

Length	Path number
8	{5, 9, 15, 20}
9	{48, 60}
10	{3, 4, 7, 8, 11, 12, 17, 18, 22, 25, 28, 33, 101, 103, 123, 126}
11	{76, 81, 87, 89, 173, 196}
12	{45, 46, 57, 58, 105, 107, 109, 111, 131, 134, 139, 143, 167, 168, 190, 191}
13	{37, 40, 90, 92, 94, 169, 192, 229, 245, 268, 284}
14	{30, 31, 35, 50, 52, 53, 54, 62, 64, 65, 66, 75, 80, 112, 114, 116, 128, 129, 146, 149, 154, 184, 207, 225, 226, 241, 242, 265, 266, 281, 282}
15	{170, 171, 185, 193, 194, 208, 212, 218, 227, 243, 267, 283, 296, 309, 328}
16	{78, 83, 96, 98, 136, 137, 141, 145, 148, 151, 156, 176, 199, 237, 253, 275, 291, 301, 304, 314, 317, 333, 336}
17	{42, 43, 118, 120, 158, 161, 180, 182, 186, 187, 203, 205, 209, 210, 228, 238, 244, 254, 256, 260, 276, 277, 292, 293, 305, 306, 318, 319, 337, 338}
18	{70, 73, 232, 248, 271, 287, 344, 357}
19	{160, 163, 239, 255, 302, 315, 334, 349, 352, 362, 365}
20	{323, 326, 342, 353, 354, 366, 367}
21	{217, 223, 324, 327, 343}
22	{350, 363}
23	{371, 374}
24	{372, 375}

Appendix 5_Length of paths_From element 21 to element 19_Positive paths

Length	Path number
4	{1}
8	{6, 10, 16, 21}
9	{44, 56}
10	{2, 24, 27, 32, 100, 102, 122, 125}
11	{74, 79, 86, 88, 166, 189}
12	{13, 14, 19, 23, 26, 29, 34, 49, 51, 61, 63, 104, 106, 108, 110, 124, 127, 130, 133, 138, 142, 174, 177, 197, 200}
13	{36, 39, 91, 93, 95, 178, 183, 201, 206, 224, 240, 264, 280}
14	{47, 59, 77, 82, 113, 115, 117, 132, 135, 140, 144, 147, 150, 155, 230, 233, 246, 249, 269, 272, 285, 288}
15	{38, 41, 175, 179, 181, 198, 202, 204, 234, 236, 250, 252, 273, 274, 289, 290, 300, 313, 332}
16	{55, 67, 68, 69, 71, 72, 97, 99, 213, 219, 297, 298, 310, 311, 329, 330}
17	{119, 121, 159, 162, 172, 195, 214, 220, 231, 235, 247, 251, 270, 286, 299, 312, 331}
18	{84, 85, 152, 153, 157, 257, 261, 278, 294, 307, 320, 339, 348, 361}
19	{188, 211, 215, 216, 221, 222, 258, 262, 279, 295, 308, 321, 322, 325, 340, 341, 345, 346, 358, 359}
20	{303, 316, 335, 347, 360}
21	{164, 165, 259, 263, 355, 368}
22	{356, 369, 370, 373}
23	{351, 364}

Appendix 5_Length of paths_From element 21 to element 27_Negative paths

Length	Path number
11	{1, 7, 89}
12	{2, 8, 90}
13	{5, 11, 17, 23, 33, 41}
14	{6, 12, 18, 24, 34, 42}
15	{21, 27, 37, 45, 51, 57, 67, 115}
16	{22, 28, 38, 46, 52, 58, 68, 116}
17	{95}
18	{75, 81, 96}
19	{61, 63, 71, 76, 82, 103, 109, 119}
20	{62, 64, 72, 104, 110, 120}
22	{85, 87, 105, 111}
23	{86, 88, 106, 112}

Appendix 5_Length of paths_From element 21 to element 27_Positive paths

Length	Path number
11	{3, 9}
12	{4, 10}
13	{19, 25, 35, 43, 91}
14	{20, 26, 36, 44, 92}
15	{13, 15, 49, 55, 65, 113}
16	{14, 16, 50, 56, 66, 93, 114}
17	{29, 31, 39, 47, 53, 59, 69, 94, 101, 107, 117}
18	{30, 32, 40, 48, 54, 60, 70, 73, 79, 102, 108, 118}
19	{74, 80, 97}
20	{77, 83, 98}
21	{78, 84}
22	{99}
23	{100}

Appendix 5_Length of paths_From element 22 to element 3_Negative paths

Length	Path number
6	{1, 2}
8	{3}
9	{11, 12, 29}
10	{9, 39, 40, 79}
11	{21, 22, 23, 80, 81}
12	{17, 52, 53, 57, 94, 95, 123, 146}
13	{33, 34, 42, 45, 67, 68, 82, 98, 107, 124, 125}
14	{15, 18, 26, 65, 96, 105, 106, 110, 144}
15	{54, 60, 70, 71, 72, 93, 99, 101, 126, 135, 165}
16	{36, 37, 113, 116, 133, 134, 138, 151, 152, 153, 154, 156, 186}
17	{49, 50, 90, 102}
18	{75, 141, 155}
19	{160, 161, 170, 171, 172, 173, 175, 187}
20	{120, 121, 163, 164}
21	{174}
22	{179, 180}
23	{182, 183}

Appendix 5_Length of paths_From element 22 to element 3_Positive paths

Length	Path number
6	{4, 5, 7}
7	{10}
8	{6, 8, 38, 78}
9	{16, 20}
10	{13, 41, 51, 63, 122}
11	{30, 31, 32, 66, 91}
12	{14, 64, 83, 84, 85, 86, 104}
13	{24, 25, 69, 88, 92}
14	{35, 58, 59, 87, 127, 128, 129, 130, 132, 145, 147}
15	{43, 44, 46, 47, 48, 89, 108, 109, 148, 149}
16	{19, 27, 28, 97, 111, 112, 131, 184}
17	{55, 56, 61, 62, 73, 74, 100, 136, 137, 150, 159, 166}
18	{114, 115, 117, 118, 119, 139, 140, 157, 158, 162, 167, 168}
19	{103, 185}
20	{76, 77, 142, 143, 169, 178}
21	{176, 177, 181}

Appendix 5_Length of paths_From element 22 to element 19_Negative paths

Length	Path number
5	{7}
7	{1}
9	{45, 50, 174, 183}
10	{2, 88, 184}
11	{6, 17, 18, 24, 25, 28, 71, 125, 156, 244, 253}
12	{47, 51, 58, 62, 177, 194, 207, 254, 324}
13	{11, 15, 20, 26, 29, 31, 32, 34, 35, 96, 100, 103, 109, 110, 137, 138, 176, 185, 200}
14	{72, 75, 77, 80, 81, 84, 85, 133, 169, 222, 229, 247, 262}
15	{33, 36, 112, 115, 116, 117, 118, 121, 122, 139, 141, 142, 144, 145, 150, 151, 178, 246, 255, 379}
16	{41, 42, 56, 57, 94, 95, 237, 266, 271, 280, 284, 302, 306, 326}
17	{61, 64, 66, 107, 108, 131, 132, 143, 146, 152, 166, 167, 182, 192, 193, 196, 197, 205, 206, 208, 209, 212, 248, 292, 293, 296, 297, 314, 315, 318, 319, 331, 337, 338}
18	{43, 190, 213, 214, 276, 288, 294, 298, 310, 316, 320, 339, 368, 372}
19	{69, 159, 168, 199, 210, 252, 260, 261, 263, 264, 300, 322, 341, 347, 348, 351, 352, 358, 359, 362, 363, 381}
20	{215, 228, 234, 236, 301, 323, 330, 332, 342, 343, 349, 353, 360, 364, 376, 386}
21	{265, 355, 366}
22	{242, 356, 367, 392, 393, 396, 397}
23	{385, 387, 394, 398}
24	{400}
25	{401}

Appendix 5_Length of paths_From element 22 to element 19_Positive paths

Length	Path number
6	{44}
7	{4, 8, 27, 99, 136}
8	{70, 173}
9	{111, 140}
10	{5, 40, 243}
11	{3, 9, 10, 13, 14, 21, 22, 46, 54}
12	{175}
13	{12, 16, 19, 23, 37, 38, 180, 325, 334}
14	{48, 49, 52, 53, 55, 82, 83, 86, 87, 89, 195, 218, 245, 335}
15	{30, 39, 59, 60, 63, 65, 101, 102, 104, 105, 106, 119, 120, 123, 124, 126, 147, 148, 153, 154, 157, 186, 187, 201, 211, 223, 224, 230, 231, 250}
16	{73, 74, 90, 91, 92, 93, 179, 181, 188, 189, 202, 203, 225, 232, 291, 295, 313, 317, 328, 336, 380, 389}
17	{67, 68, 76, 78, 113, 114, 127, 128, 129, 130, 149, 155, 158, 160, 161, 163, 164, 238, 256, 267, 268, 272, 273, 281, 282, 285, 286, 303, 304, 307, 308, 327, 390}
18	{191, 204, 226, 227, 233, 235, 239, 249, 251, 257, 258, 269, 274, 283, 287, 299, 305, 309, 321, 340, 346, 350, 357, 361}
19	{79, 97, 98, 162, 165, 198, 216, 217, 219, 220, 277, 289, 311, 329, 369, 370, 373, 374, 383}
20	{134, 135, 170, 171, 240, 241, 259, 270, 275, 278, 290, 312, 354, 365, 371, 375, 382}
21	{221, 333, 344, 377, 391, 395}
22	{172, 279, 345, 378, 384}
23	{399}
24	{388}

Appendix 5_Length of paths_From element 22 to element 27_Negative paths

Length	Path number
8	{1}
9	{2}
10	{9}
11	{10}
14	{35}
15	{36}
16	{23, 25, 53, 57, 67, 99}
17	{24, 26, 37, 54, 58, 68, 100}
18	{27, 33, 38, 43, 47, 61, 69, 73, 75, 79, 81}
19	{28, 34, 44, 48, 62, 70, 74, 76, 80, 82, 101, 103}
20	{51, 77, 83, 102, 104, 119}
21	{52, 78, 84, 93, 95, 120, 125, 127}
22	{94, 96, 105, 126, 128}
23	{97, 106, 121}
24	{98, 122}

Appendix 5_Length of paths_From element 22 to element 27_Positive paths

Length	Path number
12	{65}
13	{66}
14	{3, 5, 29}
15	{4, 6, 30, 91}
16	{7, 11, 13, 17, 19, 41, 45, 92, 111}
17	{8, 12, 14, 18, 20, 31, 42, 46, 112}
18	{15, 21, 32, 39, 49, 55, 59, 85, 87}
19	{16, 22, 40, 50, 56, 60, 86, 88, 113, 115, 123}
20	{63, 71, 89, 107, 114, 116, 124}
21	{64, 72, 90, 108}
22	{117}
23	{109, 118}
24	{110}

Appendix 5_Length of paths_From element 23 to element 3_Negative paths

Length	Path number
3	{1}
5	{4}
9	{5}
13	{8, 9}
14	{11, 12}
17	{16, 17}

Appendix 5_Length of paths_From element 23 to element 3_Positive paths

Length	Path number
5	{2, 3}
11	{10}
12	{6, 7}
14	{15}
15	{13, 14}
18	{18, 19}

Appendix 5_Length of paths_From element 23 to element 19_Negative paths

Length	Path number
2	{1}
10	{4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 20, 53, 54}
11	{86, 92}
12	{59, 60, 65, 68}
13	{23, 24, 122, 126, 146, 155}
14	{31, 34, 35, 36, 38, 39, 41, 42, 44, 45, 99, 105, 111, 117}
15	{100, 106, 112, 118}
16	{49, 50, 51, 52, 73, 74, 75, 76, 78, 79, 131, 135, 139, 143, 150, 153, 159, 162, 165, 168, 183}
17	{91, 97, 101, 102, 107, 108, 113, 114, 119, 120, 132, 136, 140, 144, 151, 154, 160, 163, 166, 169, 170, 173, 176, 179, 184, 185, 188}
19	{82, 83, 84, 85, 133, 137, 141, 145, 192, 195}
20	{193, 196, 197, 200, 203, 206}

Appendix 5_Length of paths_From element 23 to element 19_Positive paths

Length	Path number
8	{2, 3, 8, 11}
12	{16, 17, 18, 19, 21, 22, 29, 30, 32, 33, 55, 56, 57, 58, 87, 93}
13	{88, 94, 98, 104, 110, 116}
14	{47, 48, 61, 62, 63, 64, 66, 67, 69, 70, 71, 72, 77, 123, 127, 147, 156}
15	{25, 26, 27, 28, 89, 90, 95, 96, 124, 128, 130, 134, 138, 142, 148, 149, 152, 157, 158, 161, 164, 167, 182}
16	{37, 40, 43, 46}
17	{80, 81, 125, 129}
18	{171, 174, 177, 180, 186, 189, 191, 194}
19	{103, 109, 115, 121, 172, 175, 178, 181, 187, 190}
21	{198, 201, 204, 207}
22	{199, 202, 205, 208}

Appendix 5_Length of paths_From element 23 to element 27_Negative paths

Length	Path number
11	{79}
12	{80}
13	{5, 7, 9, 11}
14	{6, 8, 10, 12, 83}
15	{17, 19, 21, 23, 27, 29, 39, 41, 45, 49, 51, 61, 84}
16	{18, 20, 22, 24, 28, 30, 40, 42, 46, 50, 52, 62}
18	{67, 69}
19	{68, 70}

Appendix 5_Length of paths_From element 23 to element 27_Positive paths

Length	Path number
9	{31}
10	{32}
11	{1, 3}
12	{2, 4}
13	{13, 15, 25, 33, 35, 37}
14	{14, 16, 26, 34, 36, 38}
15	{81}
16	{82}
17	{43, 47, 53, 55, 57, 59, 63, 65}
18	{44, 48, 54, 56, 58, 60, 64, 66}
20	{71, 73, 75, 77}
21	{72, 74, 76, 78}

Appendix 5_Length of paths_From element 24 to element 3_Negative paths

Length	Path number
6	{2, 3}
12	{10}
13	{6, 7}
15	{15}
16	{13, 14}
19	{18, 19}

Appendix 5_Length of paths_From element 24 to element 3_Positive paths

Length	Path number
4	{1}
6	{4}
10	{5}
14	{8, 9}
15	{11, 12}
18	{16, 17}

Appendix 5_Length of paths_From element 24 to element 19_Negative paths

Length	Path number
9	{2, 3, 8, 11}
13	{16, 17, 18, 19, 21, 22, 29, 30, 32, 33, 55, 56, 57, 58, 87, 93}
14	{88, 94, 98, 104, 110, 116}
15	{47, 48, 61, 62, 63, 64, 66, 67, 69, 70, 71, 72, 77, 123, 127, 147, 156}
16	{25, 26, 27, 28, 89, 90, 95, 96, 124, 128, 130, 134, 138, 142, 148, 149, 152, 157, 158, 161, 164, 167, 182}
17	{37, 40, 43, 46}
18	{80, 81, 125, 129}
19	{171, 174, 177, 180, 186, 189, 191, 194}
20	{103, 109, 115, 121, 172, 175, 178, 181, 187, 190}
22	{198, 201, 204, 207}
23	{199, 202, 205, 208}

Appendix 5_Length of paths_From element 24 to element 19_Positive paths

Length	Path number
3	{1}
11	{4, 5, 6, 7, 9, 10, 12, 13, 14, 15, 20, 53, 54}
12	{86, 92}
13	{59, 60, 65, 68}
14	{23, 24, 122, 126, 146, 155}
15	{31, 34, 35, 36, 38, 39, 41, 42, 44, 45, 99, 105, 111, 117}
16	{100, 106, 112, 118}
17	{49, 50, 51, 52, 73, 74, 75, 76, 78, 79, 131, 135, 139, 143, 150, 153, 159, 162, 165, 168, 183}
18	{91, 97, 101, 102, 107, 108, 113, 114, 119, 120, 132, 136, 140, 144, 151, 154, 160, 163, 166, 169, 170, 173, 176, 179, 184, 185, 188}
20	{82, 83, 84, 85, 133, 137, 141, 145, 192, 195}
21	{193, 196, 197, 200, 203, 206}

Appendix 5_Length of paths_From element 24 to element 27_Negative paths

Length	Path number
10	{67}
11	{68}
12	{1, 3}
13	{2, 4}
14	{13, 15, 25, 31, 69, 71}
15	{14, 16, 26, 32, 70, 72}
16	{75}
17	{76}
18	{41, 43, 45, 47, 51, 53, 81, 83}
19	{42, 44, 46, 48, 52, 54, 82, 84}
21	{59, 61, 63, 65}
22	{60, 62, 64, 66}

Appendix 5_Length of paths_From element 24 to element 27_Positive paths

Length	Path number
12	{73}
13	{74}
14	{5, 7, 9, 11}
15	{6, 8, 10, 12, 77}
16	{17, 19, 21, 23, 27, 29, 33, 35, 37, 39, 49, 78, 79}
17	{18, 20, 22, 24, 28, 30, 34, 36, 38, 40, 50, 80}
19	{55, 57}
20	{56, 58}

Appendix 5_Length of paths_From element 25 to element 3_Negative paths

Length	Path number
4	{25}
6	{1}
7	{13, 38}
8	{2, 30, 31, 32, 33, 91}
9	{4, 35, 39}
10	{16, 34, 54}
11	{36, 95, 96, 112}
12	{44, 51, 63, 98, 99}
13	{8, 9, 47, 58, 59, 79, 109, 121}
14	{20, 21, 61, 62, 66, 74, 75, 85, 101, 102, 104, 105, 106, 116, 117, 137}
15	{50, 119, 120, 124, 132, 133, 143}
16	{11, 12, 68, 69, 71, 72, 82}
17	{23, 24, 77, 78, 88, 126, 127, 129, 130, 140}
18	{135, 136, 146}

Appendix 5_Length of paths_From element 25 to element 3_Positive paths

Length	Path number
6	{26}
7	{27, 28}
8	{41, 42}
9	{14, 15, 29, 45, 94}
10	{3, 43, 92, 93, 97}
11	{5, 6, 7, 40, 46, 48, 57}
12	{17, 18, 19, 55, 56, 60, 73, 100, 103, 115}
13	{37, 49, 113, 114, 118, 131}
14	{10, 52, 53, 64, 65, 67, 70}
15	{22, 76, 80, 81, 110, 111, 122, 123, 125, 128}
16	{86, 87, 107, 108, 134, 138, 139}
17	{144, 145}
18	{83, 84}
19	{89, 90, 141, 142}
20	{147, 148}

Appendix 5_Length of paths_From element 25 to element 19_Negative paths

Length	Path number
3	{1}
4	{2}
8	{4}
9	{12}
10	{53, 96, 120, 128}
11	{7, 8, 18, 19, 21, 22, 44, 45, 59, 69, 71, 89, 229, 237, 272, 273}
12	{11, 13, 23, 24, 27, 28, 46, 47, 60, 61, 196, 199, 226, 234, 295, 303}
13	{282, 283, 292, 300}
14	{26, 30, 49, 62, 100, 102, 172, 176, 184, 188}
15	{37, 41, 56, 79, 80, 81, 82, 83, 84, 86, 87, 94, 95, 97, 98, 122, 124, 125, 126, 130, 132, 133, 134, 230, 231, 278, 279, 280, 281}
16	{137, 138, 141, 143, 149, 150, 153, 155, 216, 218, 221, 223, 232, 233, 244, 245, 296, 297}
17	{85, 88, 99, 198, 201, 248, 249, 250, 251, 257, 258, 288, 289, 290, 291, 298, 299, 310, 311}
18	{110, 111, 112, 113, 114, 115, 117, 118, 145, 146, 157, 158, 203, 205, 208, 210, 314, 315, 316, 317, 323, 324}
19	{162, 165, 168, 171, 175, 178, 180, 187, 190, 192, 240, 241, 242, 243}
20	{116, 119, 206, 211, 264, 265, 266, 267, 306, 307, 308, 309}
21	{183, 195, 330, 331, 332, 333}

Appendix 5_Length of paths_From element 25 to element 19_Positive paths

Length	Path number
5	{3, 15}
6	{16}
8	{9, 52, 65}
9	{5, 17, 20, 43, 58}
11	{6, 10}
13	{14, 31, 32, 33, 34, 35, 36, 39, 40, 50, 51, 54, 55, 63, 64, 66, 67, 70, 72, 90, 121, 123, 129, 131, 136, 140, 148, 152, 259}
14	{25, 29, 48, 73, 74, 76, 77, 91, 92, 246, 247, 256, 274, 275, 276, 277, 325}
15	{38, 42, 57, 68, 197, 200, 202, 204, 207, 209, 227, 228, 235, 236, 312, 313, 322}
16	{75, 78, 93, 101, 103, 284, 285, 286, 287, 293, 294, 301, 302}
17	{104, 105, 107, 108, 127, 135, 160, 161, 163, 164, 166, 167, 169, 170, 173, 174, 177, 179, 185, 186, 189, 191, 238, 239, 262, 263}
18	{139, 142, 144, 151, 154, 156, 252, 253, 254, 255, 260, 261, 304, 305, 328, 329}
19	{106, 109, 181, 182, 193, 194, 212, 213, 214, 215, 217, 219, 222, 224, 318, 319, 320, 321, 326, 327}
20	{147, 159}
21	{220, 225, 268, 269, 270, 271}
22	{334, 335, 336, 337}

Appendix 5_Length of paths_From element 25 to element 27_Negative paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 25 to element 27_Positive paths

Length	Path number
4	{1}
5	{2}

Appendix 5_Length of paths_From element 26 to element 3_Negative paths

Length	Path number
5	{26}
6	{27, 28}
7	{41, 42}
8	{14, 15, 29, 45, 94}
9	{3, 43, 92, 93, 97}
10	{5, 6, 7, 40, 46, 48, 57}
11	{17, 18, 19, 55, 56, 60, 73, 100, 103, 115}
12	{37, 49, 113, 114, 118, 131}
13	{10, 52, 53, 64, 65, 67, 70}
14	{22, 76, 80, 81, 110, 111, 122, 123, 125, 128}
15	{86, 87, 107, 108, 134, 138, 139}
16	{144, 145}
17	{83, 84}
18	{89, 90, 141, 142}
19	{147, 148}

Appendix 5_Length of paths_From element 26 to element 3_Positive paths

Length	Path number
3	{25}
5	{1}
6	{13, 38}
7	{2, 30, 31, 32, 33, 91}
8	{4, 35, 39}
9	{16, 34, 54}
10	{36, 95, 96, 112}
11	{44, 51, 63, 98, 99}
12	{8, 9, 47, 58, 59, 79, 109, 121}
13	{20, 21, 61, 62, 66, 74, 75, 85, 101, 102, 104, 105, 106, 116, 117, 137}
14	{50, 119, 120, 124, 132, 133, 143}
15	{11, 12, 68, 69, 71, 72, 82}
16	{23, 24, 77, 78, 88, 126, 127, 129, 130, 140}
17	{135, 136, 146}

Appendix 5_Length of paths_From element 26 to element 19_Negative paths

Length	Path number
4	{3, 15}
5	{16}
7	{9, 52, 65}
8	{5, 17, 20, 43, 58}
10	{6, 10}
12	{14, 31, 32, 33, 34, 35, 36, 39, 40, 50, 51, 54, 55, 63, 64, 66, 67, 70, 72, 90, 121, 123, 129, 131, 136, 140, 148, 152, 259}
13	{25, 29, 48, 73, 74, 76, 77, 91, 92, 246, 247, 256, 274, 275, 276, 277, 325}
14	{38, 42, 57, 68, 197, 200, 202, 204, 207, 209, 227, 228, 235, 236, 312, 313, 322}
15	{75, 78, 93, 101, 103, 284, 285, 286, 287, 293, 294, 301, 302}
16	{104, 105, 107, 108, 127, 135, 160, 161, 163, 164, 166, 167, 169, 170, 173, 174, 177, 179, 185, 186, 189, 191, 238, 239, 262, 263}
17	{139, 142, 144, 151, 154, 156, 252, 253, 254, 255, 260, 261, 304, 305, 328, 329}
18	{106, 109, 181, 182, 193, 194, 212, 213, 214, 215, 217, 219, 222, 224, 318, 319, 320, 321, 326, 327}
19	{147, 159}
20	{220, 225, 268, 269, 270, 271}
21	{334, 335, 336, 337}

Appendix 5_Length of paths_From element 26 to element 19_Positive paths

Length	Path number
2	{1}
3	{2}
7	{4}
8	{12}
9	{53, 96, 120, 128}
10	{7, 8, 18, 19, 21, 22, 44, 45, 59, 69, 71, 89, 229, 237, 272, 273}
11	{11, 13, 23, 24, 27, 28, 46, 47, 60, 61, 196, 199, 226, 234, 295, 303}
12	{282, 283, 292, 300}
13	{26, 30, 49, 62, 100, 102, 172, 176, 184, 188}
14	{37, 41, 56, 79, 80, 81, 82, 83, 84, 86, 87, 94, 95, 97, 98, 122, 124, 125, 126, 130, 132, 133, 134, 230, 231, 278, 279, 280, 281}
15	{137, 138, 141, 143, 149, 150, 153, 155, 216, 218, 221, 223, 232, 233, 244, 245, 296, 297}
16	{85, 88, 99, 198, 201, 248, 249, 250, 251, 257, 258, 288, 289, 290, 291, 298, 299, 310, 311}
17	{110, 111, 112, 113, 114, 115, 117, 118, 145, 146, 157, 158, 203, 205, 208, 210, 314, 315, 316, 317, 323, 324}
18	{162, 165, 168, 171, 175, 178, 180, 187, 190, 192, 240, 241, 242, 243}
19	{116, 119, 206, 211, 264, 265, 266, 267, 306, 307, 308, 309}
20	{183, 195, 330, 331, 332, 333}

Appendix 5_Length of paths_From element 26 to element 27_Negative paths

Length	Path number
3	{1}
4	{2}

Appendix 5_Length of paths_From element 26 to element 27_Positive paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 27 to element 3_Negative paths

Length	Path number
8	{14, 15}
9	{3}
10	{5, 6, 7}
11	{17, 18, 19, 26, 35}
12	{27, 28}
13	{10}
14	{22, 29, 45}
15	{40, 41, 42, 43}
17	{44}
18	{50, 51, 52, 53}
20	{54}

Appendix 5_Length of paths_From element 27 to element 3_Positive paths

Length	Path number
5	{1}
6	{13}
7	{2}
8	{4}
9	{16, 25}
12	{8, 9}
13	{20, 21, 30, 31, 32, 33, 36}
14	{37, 38}
15	{11, 12, 34}
16	{23, 24, 39, 46}
17	{47, 48}
19	{49}

Appendix 5_Length of paths_From element 27 to element 19_Negative paths

Length	Path number
n/a	n/a

Appendix 5_Length of paths_From element 27 to element 19_Positive paths

Length	Path number
2	{1}

Appendix 5_Length of paths_From element 28 to element 3_Negative paths

Length	Path number
4	{2}
5	{3, 4}
6	{17, 18}
7	{5, 21, 70}
8	{19, 68, 69, 73}
9	{16, 22, 24, 33}
10	{31, 32, 36, 49, 76, 79, 91}
11	{13, 25, 89, 90, 94, 107}
12	{28, 29, 40, 41, 43, 46}
13	{52, 56, 57, 86, 87, 98, 99, 101, 104}
14	{62, 63, 83, 84, 110, 114, 115}
15	{120, 121}
16	{59, 60, 126, 127, 132, 133, 134}
17	{65, 66, 117, 118, 130}
18	{123, 124}

Appendix 5_Length of paths_From element 28 to element 3_Positive paths

Length	Path number
2	{1}
5	{14}
6	{6, 7, 8, 9, 67}
7	{11, 15}
8	{10, 30}
9	{12, 71, 72, 88}
10	{20, 27, 39, 74, 75}
11	{23, 34, 35, 55, 85, 97}
12	{37, 38, 42, 50, 51, 61, 77, 78, 80, 81, 82, 92, 93, 113}
13	{26, 95, 96, 100, 108, 109, 119, 128}
14	{44, 45, 47, 48, 58, 125, 131}
15	{53, 54, 64, 102, 103, 105, 106, 116, 129}
16	{111, 112, 122}
18	{135, 136}

Appendix 5_Length of paths_From element 28 to element 19_Negative paths

Length	Path number
3	{2, 14}
4	{15}
6	{8, 51, 64}
7	{4, 16, 19, 42, 57}
9	{5, 9}
11	{13, 30, 31, 32, 33, 34, 35, 38, 39, 49, 50, 53, 54, 62, 63, 65, 66, 69, 71, 89, 120, 122, 128, 130, 135, 139, 147, 151, 258, 338, 340}
12	{24, 28, 47, 72, 73, 75, 76, 90, 91, 245, 246, 255, 273, 274, 275, 276, 324, 341, 342, 344, 345, 432}
13	{37, 41, 56, 67, 196, 199, 201, 203, 206, 208, 226, 227, 234, 235, 311, 312, 321, 358, 360, 378, 395, 405, 407, 425}
14	{74, 77, 92, 100, 102, 283, 284, 285, 286, 292, 293, 300, 301, 343, 346, 361, 362, 364, 365, 379, 380, 396, 397}
15	{103, 104, 106, 107, 126, 134, 159, 160, 162, 163, 165, 166, 168, 169, 172, 173, 176, 178, 184, 185, 188, 190, 237, 238, 261, 262}
16	{138, 141, 143, 150, 153, 155, 251, 252, 253, 254, 259, 260, 303, 304, 327, 328, 363, 366, 381, 398, 436, 438}
17	{105, 108, 180, 181, 192, 193, 211, 212, 213, 214, 216, 218, 221, 223, 317, 318, 319, 320, 325, 326, 415, 416, 417, 418, 419, 420, 422, 423, 430, 431, 433, 434}
18	{146, 158, 389, 390}
19	{219, 224, 267, 268, 269, 270, 421, 424, 435}
20	{333, 334, 335, 336, 446, 447, 448, 449, 450, 451, 453, 454}
22	{452, 455}

Appendix 5_Length of paths_From element 28 to element 19_Positive paths

Length	Path number
2	{1}
6	{3}
7	{11}
8	{52, 95, 119, 127}
9	{6, 7, 17, 18, 20, 21, 43, 44, 58, 68, 70, 88, 228, 236, 271, 272, 337, 339}
10	{10, 12, 22, 23, 26, 27, 45, 46, 59, 60, 195, 198, 225, 233, 294, 302, 384, 401}
11	{281, 282, 291, 299, 357, 359, 377, 394}
12	{25, 29, 48, 61, 99, 101, 171, 175, 183, 187}
13	{36, 40, 55, 78, 79, 80, 81, 82, 83, 85, 86, 93, 94, 96, 97, 121, 123, 124, 125, 129, 131, 132, 133, 229, 230, 277, 278, 279, 280, 347, 348, 349, 350, 351, 352, 354, 355}
14	{136, 137, 140, 142, 148, 149, 152, 154, 215, 217, 220, 222, 231, 232, 243, 244, 295, 296, 385, 387}
15	{84, 87, 98, 197, 200, 247, 248, 249, 250, 256, 257, 287, 288, 289, 290, 297, 298, 309, 310, 353, 356, 367, 368, 369, 370, 371, 372, 374, 375, 382, 383, 391, 392, 399, 400, 402, 403, 406, 408, 426}
16	{109, 110, 111, 112, 113, 114, 116, 117, 144, 145, 156, 157, 202, 204, 207, 209, 313, 314, 315, 316, 322, 323, 386, 388, 409, 410, 412, 413, 427, 428}
17	{161, 164, 167, 170, 174, 177, 179, 186, 189, 191, 239, 240, 241, 242, 373, 376, 393, 404}
18	{115, 118, 205, 210, 263, 264, 265, 266, 305, 306, 307, 308, 411, 414, 429, 437, 439}
19	{182, 194, 329, 330, 331, 332, 440, 441, 443, 444}
21	{442, 445}

Appendix 5_Length of paths_From element 28 to element 27_Negative paths

Length	Path number
2	{1}
3	{2}

Appendix 5_Length of paths_From element 28 to element 27_Positive paths

Length	Path number
n/a	n/a

Appendix 6: Involved elements of paths

This chapter shows the consolidated involvement of elements in identified paths of the systemic financial crisis model. The details of this chapter are interpreted in Chapter 5.3. The background of this kind of analysis is described in Chapter 3.4.4.

The tables represent every element of the system. The tables contain four columns. The elements of the system are listed in the first column. The second column counts the overall involvement of elements. The third and fourth columns distinguish between positive and negative paths.

Appendix 6_Involved elements of paths_From element 1 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	12	6	6
Asset supply	8	4	4
Asset price	12	6	6
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	7	3	4
Attractiveness of asset	7	3	4
General rate of interest	3	1	2
Costs of new loans	3	1	2
Attractiveness of financed investments	0	0	0
New loans for investments	9	4	5
Creditworthiness of financed investors	3	1	2
Payments for new loans	6	2	4
Risk of debt default	9	4	5
Loans for investments	3	1	2
Asset cash flow	9	4	5
Payments for loans	6	2	4
Liquidity of banks	9	4	5
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	11	5	6
Creditworthiness of banks	0	0	0
Uncertainty	9	4	5
Interbank lending	9	4	5
Foreign exchange rate	0	0	0
Money supply	9	4	5

Appendix 6_Involved elements of paths_From element 1 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	241	118	123
Asset supply	138	69	69
Asset price	240	117	123
Expected risk of asset	0	0	0
Expected return of asset	186	90	96
Asset risk-return ratio	0	0	0
Market risk-return ratio	69	38	31
Attractiveness of asset	69	38	31
General rate of interest	57	26	31
Costs of new loans	138	65	73
Attractiveness of financed investments	180	88	92
New loans for investments	180	88	92
Creditworthiness of financed investors	114	55	59
Payments for new loans	144	70	74
Risk of debt default	213	103	110
Loans for investments	36	18	18
Asset cash flow	213	103	110
Payments for loans	144	70	74
Liquidity of banks	241	118	123
Euphoria	93	45	48
Short sale	0	0	0
Risk of misbehaviour	93	45	48
Risk of contagion	172	87	85
Creditworthiness of banks	11	6	5
Uncertainty	167	81	86
Interbank lending	167	81	86
Foreign exchange rate	66	32	34
Money supply	134	64	70

Appendix 6_Involved elements of paths_From element 1 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	78	40	38
Asset supply	48	24	24
Asset price	72	36	36
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	24	12	12
Attractiveness of asset	24	12	12
General rate of interest	39	20	19
Costs of new loans	38	22	16
Attractiveness of financed investments	48	26	22
New loans for investments	60	34	26
Creditworthiness of financed investors	38	22	16
Payments for new loans	46	30	16
Risk of debt default	78	40	38
Loans for investments	14	10	4
Asset cash flow	78	40	38
Payments for loans	46	30	16
Liquidity of banks	12	8	4
Euphoria	24	12	12
Short sale	0	0	0
Risk of misbehaviour	24	12	12
Risk of contagion	54	28	26
Creditworthiness of banks	0	0	0
Uncertainty	78	40	38
Interbank lending	78	40	38
Foreign exchange rate	78	40	38
Money supply	78	40	38

Appendix 6_Involved elements of paths_From element 2 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	1	0	1
Asset price	1	0	1
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	0	0	0
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	0	0	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	0	0	0
Interbank lending	0	0	0
Foreign exchange rate	0	0	0
Money supply	0	0	0

Appendix 6_Involved elements of paths_From element 2 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	34	13	21
Asset supply	136	67	69
Asset price	136	67	69
Expected risk of asset	1	1	0
Expected return of asset	102	50	52
Asset risk-return ratio	3	1	2
Market risk-return ratio	22	11	11
Attractiveness of asset	25	12	13
General rate of interest	32	17	15
Costs of new loans	71	37	34
Attractiveness of financed investments	99	48	51
New loans for investments	99	48	51
Creditworthiness of financed investors	61	31	30
Payments for new loans	72	38	34
Risk of debt default	119	61	58
Loans for investments	20	10	10
Asset cash flow	119	61	58
Payments for loans	72	38	34
Liquidity of banks	136	67	69
Euphoria	52	26	26
Short sale	2	1	1
Risk of misbehaviour	52	26	26
Risk of contagion	67	29	38
Creditworthiness of banks	11	5	6
Uncertainty	87	45	42
Interbank lending	87	45	42
Foreign exchange rate	22	12	10
Money supply	76	40	36

Appendix 6_Involved elements of paths_From element 2 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	30	14	16
Asset supply	54	26	28
Asset price	54	26	28
Expected risk of asset	6	4	2
Expected return of asset	28	12	16
Asset risk-return ratio	18	8	10
Market risk-return ratio	0	0	0
Attractiveness of asset	18	8	10
General rate of interest	27	13	14
Costs of new loans	22	8	14
Attractiveness of financed investments	16	6	10
New loans for investments	48	20	28
Creditworthiness of financed investors	22	8	14
Payments for new loans	34	10	24
Risk of debt default	54	26	28
Loans for investments	14	4	10
Asset cash flow	54	26	28
Payments for loans	34	10	24
Liquidity of banks	32	14	18
Euphoria	20	10	10
Short sale	12	6	6
Risk of misbehaviour	20	10	10
Risk of contagion	30	14	16
Creditworthiness of banks	0	0	0
Uncertainty	54	26	28
Interbank lending	54	26	28
Foreign exchange rate	54	26	28
Money supply	54	26	28

Appendix 6_Involved elements of paths_From element 3 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	34	21	13
Asset supply	0	0	0
Asset price	136	69	67
Expected risk of asset	1	0	1
Expected return of asset	102	52	50
Asset risk-return ratio	3	2	1
Market risk-return ratio	22	11	11
Attractiveness of asset	25	13	12
General rate of interest	32	15	17
Costs of new loans	71	34	37
Attractiveness of financed investments	99	51	48
New loans for investments	99	51	48
Creditworthiness of financed investors	61	30	31
Payments for new loans	72	34	38
Risk of debt default	119	58	61
Loans for investments	20	10	10
Asset cash flow	119	58	61
Payments for loans	72	34	38
Liquidity of banks	136	69	67
Euphoria	52	26	26
Short sale	2	1	1
Risk of misbehaviour	52	26	26
Risk of contagion	67	38	29
Creditworthiness of banks	11	6	5
Uncertainty	87	42	45
Interbank lending	87	42	45
Foreign exchange rate	22	10	12
Money supply	76	36	40

Appendix 6_Involved elements of paths_From element 3 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	30	16	14
Asset supply	0	0	0
Asset price	54	28	26
Expected risk of asset	6	2	4
Expected return of asset	28	16	12
Asset risk-return ratio	18	10	8
Market risk-return ratio	0	0	0
Attractiveness of asset	18	10	8
General rate of interest	27	14	13
Costs of new loans	22	14	8
Attractiveness of financed investments	16	10	6
New loans for investments	48	28	20
Creditworthiness of financed investors	22	14	8
Payments for new loans	34	24	10
Risk of debt default	54	28	26
Loans for investments	14	10	4
Asset cash flow	54	28	26
Payments for loans	34	24	10
Liquidity of banks	32	18	14
Euphoria	20	10	10
Short sale	12	6	6
Risk of misbehaviour	20	10	10
Risk of contagion	30	16	14
Creditworthiness of banks	0	0	0
Uncertainty	54	28	26
Interbank lending	54	28	26
Foreign exchange rate	54	28	26
Money supply	54	28	26

Appendix 6_Involved elements of paths_From element 4 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	5	2	3
Asset supply	2	0	2
Asset price	6	2	4
Expected risk of asset	6	2	4
Expected return of asset	0	0	0
Asset risk-return ratio	6	2	4
Market risk-return ratio	0	0	0
Attractiveness of asset	6	2	4
General rate of interest	0	0	0
Costs of new loans	1	1	0
Attractiveness of financed investments	0	0	0
New loans for investments	3	2	1
Creditworthiness of financed investors	1	1	0
Payments for new loans	2	2	0
Risk of debt default	3	2	1
Loans for investments	1	1	0
Asset cash flow	3	2	1
Payments for loans	2	2	0
Liquidity of banks	3	2	1
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	4	2	2
Creditworthiness of banks	0	0	0
Uncertainty	3	2	1
Interbank lending	3	2	1
Foreign exchange rate	0	0	0
Money supply	3	2	1

Appendix 6_Involved elements of paths_From element 4 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	181	93	88
Asset supply	180	93	87
Asset price	282	147	135
Expected risk of asset	283	147	136
Expected return of asset	216	114	102
Asset risk-return ratio	283	147	136
Market risk-return ratio	0	0	0
Attractiveness of asset	283	147	136
General rate of interest	59	36	23
Costs of new loans	158	88	70
Attractiveness of financed investments	211	107	104
New loans for investments	211	107	104
Creditworthiness of financed investors	132	70	62
Payments for new loans	162	85	77
Risk of debt default	250	134	116
Loans for investments	42	20	22
Asset cash flow	250	134	116
Payments for loans	162	85	77
Liquidity of banks	283	147	136
Euphoria	109	58	51
Short sale	2	1	1
Risk of misbehaviour	108	57	51
Risk of contagion	145	71	74
Creditworthiness of banks	22	10	12
Uncertainty	180	96	84
Interbank lending	180	96	84
Foreign exchange rate	66	36	30
Money supply	147	81	66

Appendix 6_Involved elements of paths_From element 4 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	66	32	34
Asset supply	60	30	30
Asset price	84	42	42
Expected risk of asset	90	44	46
Expected return of asset	48	24	24
Asset risk-return ratio	90	44	46
Market risk-return ratio	0	0	0
Attractiveness of asset	90	44	46
General rate of interest	45	22	23
Costs of new loans	42	14	28
Attractiveness of financed investments	48	18	30
New loans for investments	72	26	46
Creditworthiness of financed investors	42	14	28
Payments for new loans	54	10	44
Risk of debt default	90	44	46
Loans for investments	18	2	16
Asset cash flow	90	44	46
Payments for loans	54	10	44
Liquidity of banks	24	8	16
Euphoria	30	16	14
Short sale	12	6	6
Risk of misbehaviour	24	12	12
Risk of contagion	42	20	22
Creditworthiness of banks	0	0	0
Uncertainty	90	44	46
Interbank lending	90	44	46
Foreign exchange rate	90	44	46
Money supply	90	44	46

Appendix 6_Involved elements of paths_From element 5 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	90	48	42
Asset supply	114	58	56
Asset price	181	94	87
Expected risk of asset	0	0	0
Expected return of asset	181	94	87
Asset risk-return ratio	6	4	2
Market risk-return ratio	111	58	53
Attractiveness of asset	117	62	55
General rate of interest	45	23	22
Costs of new loans	68	35	33
Attractiveness of financed investments	120	62	58
New loans for investments	144	73	71
Creditworthiness of financed investors	50	25	25
Payments for new loans	88	42	46
Risk of debt default	166	85	81
Loans for investments	32	15	17
Asset cash flow	166	85	81
Payments for loans	88	42	46
Liquidity of banks	105	53	52
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	150	77	73
Creditworthiness of banks	94	49	45
Uncertainty	122	61	61
Interbank lending	122	61	61
Foreign exchange rate	30	14	16
Money supply	107	53	54

Appendix 6_Involved elements of paths_From element 5 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	131	69	62
Asset supply	110	55	55
Asset price	179	90	89
Expected risk of asset	4	2	2
Expected return of asset	230	116	114
Asset risk-return ratio	71	36	35
Market risk-return ratio	79	42	37
Attractiveness of asset	150	78	72
General rate of interest	46	18	28
Costs of new loans	176	88	88
Attractiveness of financed investments	172	88	84
New loans for investments	172	88	84
Creditworthiness of financed investors	171	86	85
Payments for new loans	148	74	74
Risk of debt default	210	106	104
Loans for investments	17	9	8
Asset cash flow	210	106	104
Payments for loans	148	74	74
Liquidity of banks	230	116	114
Euphoria	13	6	7
Short sale	26	13	13
Risk of misbehaviour	4	2	2
Risk of contagion	148	79	69
Creditworthiness of banks	23	14	9
Uncertainty	159	76	83
Interbank lending	159	76	83
Foreign exchange rate	32	12	20
Money supply	143	66	77

Appendix 6_Involved elements of paths_From element 5 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	42	20	22
Asset supply	36	18	18
Asset price	48	22	26
Expected risk of asset	0	0	0
Expected return of asset	62	30	32
Asset risk-return ratio	42	22	20
Market risk-return ratio	6	2	4
Attractiveness of asset	48	24	24
General rate of interest	31	15	16
Costs of new loans	44	22	22
Attractiveness of financed investments	30	14	16
New loans for investments	54	30	24
Creditworthiness of financed investors	44	22	22
Payments for new loans	46	28	18
Risk of debt default	62	30	32
Loans for investments	8	6	2
Asset cash flow	62	30	32
Payments for loans	46	28	18
Liquidity of banks	30	18	12
Euphoria	6	2	4
Short sale	12	6	6
Risk of misbehaviour	0	0	0
Risk of contagion	36	18	18
Creditworthiness of banks	6	2	4
Uncertainty	62	30	32
Interbank lending	62	30	32
Foreign exchange rate	62	30	32
Money supply	62	30	32

Appendix 6_Involved elements of paths_From element 6 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	5	3	2
Asset supply	2	2	0
Asset price	6	4	2
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	6	4	2
Market risk-return ratio	0	0	0
Attractiveness of asset	6	4	2
General rate of interest	0	0	0
Costs of new loans	1	0	1
Attractiveness of financed investments	0	0	0
New loans for investments	3	1	2
Creditworthiness of financed investors	1	0	1
Payments for new loans	2	0	2
Risk of debt default	3	1	2
Loans for investments	1	0	1
Asset cash flow	3	1	2
Payments for loans	2	0	2
Liquidity of banks	3	1	2
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	4	2	2
Creditworthiness of banks	0	0	0
Uncertainty	3	1	2
Interbank lending	3	1	2
Foreign exchange rate	0	0	0
Money supply	3	1	2

Appendix 6_Involved elements of paths_From element 6 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	181	88	93
Asset supply	180	87	93
Asset price	282	135	147
Expected risk of asset	0	0	0
Expected return of asset	216	102	114
Asset risk-return ratio	283	136	147
Market risk-return ratio	0	0	0
Attractiveness of asset	283	136	147
General rate of interest	59	23	36
Costs of new loans	158	70	88
Attractiveness of financed investments	211	104	107
New loans for investments	211	104	107
Creditworthiness of financed investors	132	62	70
Payments for new loans	162	77	85
Risk of debt default	250	116	134
Loans for investments	42	22	20
Asset cash flow	250	116	134
Payments for loans	162	77	85
Liquidity of banks	283	136	147
Euphoria	109	51	58
Short sale	2	1	1
Risk of misbehaviour	108	51	57
Risk of contagion	145	74	71
Creditworthiness of banks	22	12	10
Uncertainty	180	84	96
Interbank lending	180	84	96
Foreign exchange rate	66	30	36
Money supply	147	66	81

Appendix 6_Involved elements of paths_From element 6 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	66	34	32
Asset supply	60	30	30
Asset price	84	42	42
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	90	46	44
Market risk-return ratio	0	0	0
Attractiveness of asset	90	46	44
General rate of interest	45	23	22
Costs of new loans	42	28	14
Attractiveness of financed investments	48	30	18
New loans for investments	72	46	26
Creditworthiness of financed investors	42	28	14
Payments for new loans	54	44	10
Risk of debt default	90	46	44
Loans for investments	18	16	2
Asset cash flow	90	46	44
Payments for loans	54	44	10
Liquidity of banks	24	16	8
Euphoria	30	14	16
Short sale	12	6	6
Risk of misbehaviour	24	12	12
Risk of contagion	42	22	20
Creditworthiness of banks	0	0	0
Uncertainty	90	46	44
Interbank lending	90	46	44
Foreign exchange rate	90	46	44
Money supply	90	46	44

Appendix 6_Involved elements of paths_From element 7 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	5	2	3
Asset supply	2	0	2
Asset price	6	2	4
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	6	2	4
Attractiveness of asset	6	2	4
General rate of interest	0	0	0
Costs of new loans	1	1	0
Attractiveness of financed investments	0	0	0
New loans for investments	3	2	1
Creditworthiness of financed investors	1	1	0
Payments for new loans	2	2	0
Risk of debt default	3	2	1
Loans for investments	1	1	0
Asset cash flow	3	2	1
Payments for loans	2	2	0
Liquidity of banks	3	2	1
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	4	2	2
Creditworthiness of banks	0	0	0
Uncertainty	3	2	1
Interbank lending	3	2	1
Foreign exchange rate	0	0	0
Money supply	3	2	1

Appendix 6_Involved elements of paths_From element 7 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	181	93	88
Asset supply	180	93	87
Asset price	282	147	135
Expected risk of asset	0	0	0
Expected return of asset	216	114	102
Asset risk-return ratio	0	0	0
Market risk-return ratio	283	147	136
Attractiveness of asset	283	147	136
General rate of interest	59	36	23
Costs of new loans	158	88	70
Attractiveness of financed investments	211	107	104
New loans for investments	211	107	104
Creditworthiness of financed investors	132	70	62
Payments for new loans	162	85	77
Risk of debt default	250	134	116
Loans for investments	42	20	22
Asset cash flow	250	134	116
Payments for loans	162	85	77
Liquidity of banks	283	147	136
Euphoria	109	58	51
Short sale	2	1	1
Risk of misbehaviour	108	57	51
Risk of contagion	145	71	74
Creditworthiness of banks	22	10	12
Uncertainty	180	96	84
Interbank lending	180	96	84
Foreign exchange rate	66	36	30
Money supply	147	81	66

Appendix 6_Involved elements of paths_From element 7 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	66	32	34
Asset supply	60	30	30
Asset price	84	42	42
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	90	44	46
Attractiveness of asset	90	44	46
General rate of interest	45	22	23
Costs of new loans	42	14	28
Attractiveness of financed investments	48	18	30
New loans for investments	72	26	46
Creditworthiness of financed investors	42	14	28
Payments for new loans	54	10	44
Risk of debt default	90	44	46
Loans for investments	18	2	16
Asset cash flow	90	44	46
Payments for loans	54	10	44
Liquidity of banks	24	8	16
Euphoria	30	16	14
Short sale	12	6	6
Risk of misbehaviour	24	12	12
Risk of contagion	42	20	22
Creditworthiness of banks	0	0	0
Uncertainty	90	44	46
Interbank lending	90	44	46
Foreign exchange rate	90	44	46
Money supply	90	44	46

Appendix 6_Involved elements of paths_From element 8 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	5	3	2
Asset supply	2	2	0
Asset price	6	4	2
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	6	4	2
General rate of interest	0	0	0
Costs of new loans	1	0	1
Attractiveness of financed investments	0	0	0
New loans for investments	3	1	2
Creditworthiness of financed investors	1	0	1
Payments for new loans	2	0	2
Risk of debt default	3	1	2
Loans for investments	1	0	1
Asset cash flow	3	1	2
Payments for loans	2	0	2
Liquidity of banks	3	1	2
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	4	2	2
Creditworthiness of banks	0	0	0
Uncertainty	3	1	2
Interbank lending	3	1	2
Foreign exchange rate	0	0	0
Money supply	3	1	2

Appendix 6_Involved elements of paths_From element 8 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	181	88	93
Asset supply	180	87	93
Asset price	282	135	147
Expected risk of asset	0	0	0
Expected return of asset	216	102	114
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	283	136	147
General rate of interest	59	23	36
Costs of new loans	158	70	88
Attractiveness of financed investments	211	104	107
New loans for investments	211	104	107
Creditworthiness of financed investors	132	62	70
Payments for new loans	162	77	85
Risk of debt default	250	116	134
Loans for investments	42	22	20
Asset cash flow	250	116	134
Payments for loans	162	77	85
Liquidity of banks	283	136	147
Euphoria	109	51	58
Short sale	2	1	1
Risk of misbehaviour	108	51	57
Risk of contagion	145	74	71
Creditworthiness of banks	22	12	10
Uncertainty	180	84	96
Interbank lending	180	84	96
Foreign exchange rate	66	30	36
Money supply	147	66	81

Appendix 6_Involved elements of paths_From element 8 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	66	34	32
Asset supply	60	30	30
Asset price	84	42	42
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	90	46	44
General rate of interest	45	23	22
Costs of new loans	42	28	14
Attractiveness of financed investments	48	30	18
New loans for investments	72	46	26
Creditworthiness of financed investors	42	28	14
Payments for new loans	54	44	10
Risk of debt default	90	46	44
Loans for investments	18	16	2
Asset cash flow	90	46	44
Payments for loans	54	44	10
Liquidity of banks	24	16	8
Euphoria	30	14	16
Short sale	12	6	6
Risk of misbehaviour	24	12	12
Risk of contagion	42	22	20
Creditworthiness of banks	0	0	0
Uncertainty	90	46	44
Interbank lending	90	46	44
Foreign exchange rate	90	46	44
Money supply	90	46	44

Appendix 6_Involved elements of paths_From element 9 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	74	37	37
Asset supply	96	48	48
Asset price	157	78	79
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	101	51	50
Attractiveness of asset	101	51	50
General rate of interest	157	78	79
Costs of new loans	120	61	59
Attractiveness of financed investments	53	26	27
New loans for investments	126	63	63
Creditworthiness of financed investors	14	9	5
Payments for new loans	106	55	51
Risk of debt default	133	68	65
Loans for investments	14	9	5
Asset cash flow	133	68	65
Payments for loans	106	55	51
Liquidity of banks	112	56	56
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	128	64	64
Creditworthiness of banks	61	30	31
Uncertainty	89	46	43
Interbank lending	89	46	43
Foreign exchange rate	57	30	27
Money supply	77	40	37

Appendix 6_Involved elements of paths_From element 9 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	204	95	109
Asset supply	176	86	90
Asset price	298	143	155
Expected risk of asset	3	2	1
Expected return of asset	226	108	118
Asset risk-return ratio	9	4	5
Market risk-return ratio	259	126	133
Attractiveness of asset	268	130	138
General rate of interest	325	156	169
Costs of new loans	217	108	109
Attractiveness of financed investments	252	123	129
New loans for investments	252	123	129
Creditworthiness of financed investors	117	64	53
Payments for new loans	186	97	89
Risk of debt default	287	140	147
Loans for investments	36	20	16
Asset cash flow	287	140	147
Payments for loans	186	97	89
Liquidity of banks	325	156	169
Euphoria	120	58	62
Short sale	14	7	7
Risk of misbehaviour	116	56	60
Risk of contagion	200	93	107
Creditworthiness of banks	33	13	20
Uncertainty	195	96	99
Interbank lending	195	96	99
Foreign exchange rate	43	25	18
Money supply	153	78	75

Appendix 6_Involved elements of paths_From element 9 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	53	28	25
Asset supply	54	27	27
Asset price	78	41	37
Expected risk of asset	0	0	0
Expected return of asset	60	32	28
Asset risk-return ratio	0	0	0
Market risk-return ratio	65	36	29
Attractiveness of asset	65	36	29
General rate of interest	86	45	41
Costs of new loans	61	29	32
Attractiveness of financed investments	50	24	26
New loans for investments	69	30	39
Creditworthiness of financed investors	21	7	14
Payments for new loans	54	18	36
Risk of debt default	85	44	41
Loans for investments	9	1	8
Asset cash flow	85	44	41
Payments for loans	54	18	36
Liquidity of banks	43	20	23
Euphoria	33	18	15
Short sale	6	3	3
Risk of misbehaviour	30	16	14
Risk of contagion	53	28	25
Creditworthiness of banks	24	14	10
Uncertainty	85	44	41
Interbank lending	85	44	41
Foreign exchange rate	86	45	41
Money supply	85	44	41

Appendix 6_Involved elements of paths_From element 10 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	64	31	33
Asset supply	82	41	41
Asset price	130	64	66
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	84	41	43
Attractiveness of asset	84	41	43
General rate of interest	24	12	12
Costs of new loans	130	64	66
Attractiveness of financed investments	65	32	33
New loans for investments	99	49	50
Creditworthiness of financed investors	0	0	0
Payments for new loans	96	48	48
Risk of debt default	115	57	58
Loans for investments	0	0	0
Asset cash flow	115	57	58
Payments for loans	96	48	48
Liquidity of banks	79	39	40
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	104	51	53
Creditworthiness of banks	58	28	30
Uncertainty	89	45	44
Interbank lending	89	45	44
Foreign exchange rate	24	12	12
Money supply	77	39	38

Appendix 6_Involved elements of paths_From element 10 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	84	38	46
Asset supply	52	26	26
Asset price	95	45	50
Expected risk of asset	3	2	1
Expected return of asset	74	34	40
Asset risk-return ratio	9	4	5
Market risk-return ratio	54	25	29
Attractiveness of asset	63	29	34
General rate of interest	26	16	10
Costs of new loans	126	60	66
Attractiveness of financed investments	107	51	56
New loans for investments	107	51	56
Creditworthiness of financed investors	0	0	0
Payments for new loans	76	37	39
Risk of debt default	122	58	64
Loans for investments	0	0	0
Asset cash flow	122	58	64
Payments for loans	76	37	39
Liquidity of banks	126	60	66
Euphoria	46	22	24
Short sale	18	9	9
Risk of misbehaviour	40	19	21
Risk of contagion	93	42	51
Creditworthiness of banks	11	3	8
Uncertainty	100	52	48
Interbank lending	100	52	48
Foreign exchange rate	18	12	6
Money supply	91	49	42

Appendix 6_Involved elements of paths_From element 10 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	40	24	16
Asset supply	48	24	24
Asset price	72	40	32
Expected risk of asset	0	0	0
Expected return of asset	72	40	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	40	28	12
Attractiveness of asset	40	28	12
General rate of interest	40	22	18
Costs of new loans	80	44	36
Attractiveness of financed investments	52	30	22
New loans for investments	66	34	32
Creditworthiness of financed investors	0	0	0
Payments for new loans	54	26	28
Risk of debt default	80	44	36
Loans for investments	0	0	0
Asset cash flow	80	44	36
Payments for loans	54	26	28
Liquidity of banks	62	32	30
Euphoria	36	20	16
Short sale	0	0	0
Risk of misbehaviour	36	20	16
Risk of contagion	64	36	28
Creditworthiness of banks	48	28	20
Uncertainty	80	44	36
Interbank lending	80	44	36
Foreign exchange rate	80	44	36
Money supply	80	44	36

Appendix 6_Involved elements of paths_From element 11 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	41	22	19
Asset supply	66	33	33
Asset price	102	52	50
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	71	37	34
Attractiveness of asset	71	37	34
General rate of interest	21	9	12
Costs of new loans	37	19	18
Attractiveness of financed investments	102	52	50
New loans for investments	102	52	50
Creditworthiness of financed investors	34	17	17
Payments for new loans	68	34	34
Risk of debt default	90	46	44
Loans for investments	31	15	16
Asset cash flow	90	46	44
Payments for loans	68	34	34
Liquidity of banks	51	26	25
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	86	44	42
Creditworthiness of banks	60	31	29
Uncertainty	69	34	35
Interbank lending	69	34	35
Foreign exchange rate	18	8	10
Money supply	60	29	31

Appendix 6_Involved elements of paths_From element 11 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	101	50	51
Asset supply	56	28	28
Asset price	103	50	53
Expected risk of asset	3	2	1
Expected return of asset	48	22	26
Asset risk-return ratio	9	4	5
Market risk-return ratio	47	27	20
Attractiveness of asset	56	31	25
General rate of interest	31	11	20
Costs of new loans	67	30	37
Attractiveness of financed investments	136	66	70
New loans for investments	136	66	70
Creditworthiness of financed investors	60	28	32
Payments for new loans	86	39	47
Risk of debt default	129	62	67
Loans for investments	19	9	10
Asset cash flow	129	62	67
Payments for loans	86	39	47
Liquidity of banks	136	66	70
Euphoria	33	16	17
Short sale	18	9	9
Risk of misbehaviour	27	13	14
Risk of contagion	97	50	47
Creditworthiness of banks	9	6	3
Uncertainty	104	48	56
Interbank lending	104	48	56
Foreign exchange rate	24	10	14
Money supply	92	41	51

Appendix 6_Involved elements of paths_From element 11 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	32	14	18
Asset supply	40	20	20
Asset price	60	28	32
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	34	22	12
Attractiveness of asset	34	22	12
General rate of interest	33	16	17
Costs of new loans	26	14	12
Attractiveness of financed investments	66	32	34
New loans for investments	66	32	34
Creditworthiness of financed investors	26	14	12
Payments for new loans	40	24	16
Risk of debt default	66	32	34
Loans for investments	14	10	4
Asset cash flow	66	32	34
Payments for loans	40	24	16
Liquidity of banks	42	22	20
Euphoria	24	12	12
Short sale	0	0	0
Risk of misbehaviour	24	12	12
Risk of contagion	54	28	26
Creditworthiness of banks	42	22	20
Uncertainty	66	32	34
Interbank lending	66	32	34
Foreign exchange rate	66	32	34
Money supply	66	32	34

Appendix 6_Involved elements of paths_From element 12 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	41	22	19
Asset supply	66	33	33
Asset price	102	52	50
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	71	37	34
Attractiveness of asset	71	37	34
General rate of interest	21	9	12
Costs of new loans	37	19	18
Attractiveness of financed investments	0	0	0
New loans for investments	102	52	50
Creditworthiness of financed investors	34	17	17
Payments for new loans	68	34	34
Risk of debt default	90	46	44
Loans for investments	31	15	16
Asset cash flow	90	46	44
Payments for loans	68	34	34
Liquidity of banks	51	26	25
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	86	44	42
Creditworthiness of banks	60	31	29
Uncertainty	69	34	35
Interbank lending	69	34	35
Foreign exchange rate	18	8	10
Money supply	60	29	31

Appendix 6_Involved elements of paths_From element 12 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	101	50	51
Asset supply	56	28	28
Asset price	103	50	53
Expected risk of asset	3	2	1
Expected return of asset	48	22	26
Asset risk-return ratio	9	4	5
Market risk-return ratio	47	27	20
Attractiveness of asset	56	31	25
General rate of interest	31	11	20
Costs of new loans	67	30	37
Attractiveness of financed investments	0	0	0
New loans for investments	136	66	70
Creditworthiness of financed investors	60	28	32
Payments for new loans	86	39	47
Risk of debt default	129	62	67
Loans for investments	19	9	10
Asset cash flow	129	62	67
Payments for loans	86	39	47
Liquidity of banks	136	66	70
Euphoria	33	16	17
Short sale	18	9	9
Risk of misbehaviour	27	13	14
Risk of contagion	97	50	47
Creditworthiness of banks	9	6	3
Uncertainty	104	48	56
Interbank lending	104	48	56
Foreign exchange rate	24	10	14
Money supply	92	41	51

Appendix 6_Involved elements of paths_From element 12 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	32	14	18
Asset supply	40	20	20
Asset price	60	28	32
Expected risk of asset	0	0	0
Expected return of asset	48	24	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	34	22	12
Attractiveness of asset	34	22	12
General rate of interest	33	16	17
Costs of new loans	26	14	12
Attractiveness of financed investments	0	0	0
New loans for investments	66	32	34
Creditworthiness of financed investors	26	14	12
Payments for new loans	40	24	16
Risk of debt default	66	32	34
Loans for investments	14	10	4
Asset cash flow	66	32	34
Payments for loans	40	24	16
Liquidity of banks	42	22	20
Euphoria	24	12	12
Short sale	0	0	0
Risk of misbehaviour	24	12	12
Risk of contagion	54	28	26
Creditworthiness of banks	42	22	20
Uncertainty	66	32	34
Interbank lending	66	32	34
Foreign exchange rate	66	32	34
Money supply	66	32	34

Appendix 6_Involved elements of paths_From element 13 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	64	33	31
Asset supply	82	41	41
Asset price	130	66	64
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	84	43	41
Attractiveness of asset	84	43	41
General rate of interest	24	12	12
Costs of new loans	130	66	64
Attractiveness of financed investments	65	33	32
New loans for investments	99	50	49
Creditworthiness of financed investors	130	66	64
Payments for new loans	96	48	48
Risk of debt default	115	58	57
Loans for investments	0	0	0
Asset cash flow	115	58	57
Payments for loans	96	48	48
Liquidity of banks	79	40	39
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	104	53	51
Creditworthiness of banks	58	30	28
Uncertainty	89	44	45
Interbank lending	89	44	45
Foreign exchange rate	24	12	12
Money supply	77	38	39

Appendix 6_Involved elements of paths_From element 13 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	84	46	38
Asset supply	52	26	26
Asset price	95	50	45
Expected risk of asset	3	1	2
Expected return of asset	74	40	34
Asset risk-return ratio	9	5	4
Market risk-return ratio	54	29	25
Attractiveness of asset	63	34	29
General rate of interest	26	10	16
Costs of new loans	126	66	60
Attractiveness of financed investments	107	56	51
New loans for investments	107	56	51
Creditworthiness of financed investors	126	66	60
Payments for new loans	76	39	37
Risk of debt default	122	64	58
Loans for investments	0	0	0
Asset cash flow	122	64	58
Payments for loans	76	39	37
Liquidity of banks	126	66	60
Euphoria	46	24	22
Short sale	18	9	9
Risk of misbehaviour	40	21	19
Risk of contagion	93	51	42
Creditworthiness of banks	11	8	3
Uncertainty	100	48	52
Interbank lending	100	48	52
Foreign exchange rate	18	6	12
Money supply	91	42	49

Appendix 6_Involved elements of paths_From element 13 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	40	16	24
Asset supply	48	24	24
Asset price	72	32	40
Expected risk of asset	0	0	0
Expected return of asset	72	32	40
Asset risk-return ratio	0	0	0
Market risk-return ratio	40	12	28
Attractiveness of asset	40	12	28
General rate of interest	40	18	22
Costs of new loans	80	36	44
Attractiveness of financed investments	52	22	30
New loans for investments	66	32	34
Creditworthiness of financed investors	80	36	44
Payments for new loans	54	28	26
Risk of debt default	80	36	44
Loans for investments	0	0	0
Asset cash flow	80	36	44
Payments for loans	54	28	26
Liquidity of banks	62	30	32
Euphoria	36	16	20
Short sale	0	0	0
Risk of misbehaviour	36	16	20
Risk of contagion	64	28	36
Creditworthiness of banks	48	20	28
Uncertainty	80	36	44
Interbank lending	80	36	44
Foreign exchange rate	80	36	44
Money supply	80	36	44

Appendix 6_Involved elements of paths_From element 14 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	60	28	32
Asset supply	70	35	35
Asset price	111	54	57
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	68	31	37
Attractiveness of asset	68	31	37
General rate of interest	24	13	11
Costs of new loans	46	22	24
Attractiveness of financed investments	46	22	24
New loans for investments	80	39	41
Creditworthiness of financed investors	40	20	20
Payments for new loans	111	54	57
Risk of debt default	99	47	52
Loans for investments	34	18	16
Asset cash flow	99	47	52
Payments for loans	111	54	57
Liquidity of banks	70	34	36
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	88	42	46
Creditworthiness of banks	46	21	25
Uncertainty	73	37	36
Interbank lending	73	37	36
Foreign exchange rate	18	10	8
Money supply	64	33	31

Appendix 6_Involved elements of paths_From element 14 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	85	40	45
Asset supply	60	30	30
Asset price	105	52	53
Expected risk of asset	2	1	1
Expected return of asset	72	36	36
Asset risk-return ratio	6	3	3
Market risk-return ratio	62	28	34
Attractiveness of asset	68	31	37
General rate of interest	28	16	12
Costs of new loans	73	38	35
Attractiveness of financed investments	111	56	55
New loans for investments	111	56	55
Creditworthiness of financed investors	71	37	34
Payments for new loans	130	65	65
Risk of debt default	127	63	64
Loans for investments	50	27	23
Asset cash flow	127	63	64
Payments for loans	130	65	65
Liquidity of banks	130	65	65
Euphoria	42	21	21
Short sale	12	6	6
Risk of misbehaviour	38	19	19
Risk of contagion	95	45	50
Creditworthiness of banks	13	6	7
Uncertainty	99	50	49
Interbank lending	99	50	49
Foreign exchange rate	16	6	10
Money supply	91	45	46

Appendix 6_Involved elements of paths_From element 14 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	38	18	20
Asset supply	44	22	22
Asset price	66	32	34
Expected risk of asset	0	0	0
Expected return of asset	60	28	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	36	28	8
Attractiveness of asset	36	28	8
General rate of interest	36	17	19
Costs of new loans	32	12	20
Attractiveness of financed investments	44	20	24
New loans for investments	58	24	34
Creditworthiness of financed investors	32	12	20
Payments for new loans	72	34	38
Risk of debt default	72	34	38
Loans for investments	26	8	18
Asset cash flow	72	34	38
Payments for loans	72	34	38
Liquidity of banks	56	28	28
Euphoria	30	14	16
Short sale	0	0	0
Risk of misbehaviour	30	14	16
Risk of contagion	58	32	26
Creditworthiness of banks	42	24	18
Uncertainty	72	34	38
Interbank lending	72	34	38
Foreign exchange rate	72	34	38
Money supply	72	34	38

Appendix 6_Involved elements of paths_From element 15 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	44	21	23
Asset supply	46	23	23
Asset price	73	35	38
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	40	19	21
Attractiveness of asset	40	19	21
General rate of interest	24	10	14
Costs of new loans	30	14	16
Attractiveness of financed investments	18	8	10
New loans for investments	39	19	20
Creditworthiness of financed investors	15	7	8
Payments for new loans	18	10	8
Risk of debt default	73	35	38
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	18	10	8
Liquidity of banks	51	25	26
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	60	29	31
Creditworthiness of banks	34	16	18
Uncertainty	50	24	26
Interbank lending	50	24	26
Foreign exchange rate	12	6	6
Money supply	44	21	23

Appendix 6_Involved elements of paths_From element 15 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	85	40	45
Asset supply	100	50	50
Asset price	162	79	83
Expected risk of asset	1	1	0
Expected return of asset	104	50	54
Asset risk-return ratio	3	1	2
Market risk-return ratio	120	61	59
Attractiveness of asset	123	62	61
General rate of interest	38	16	22
Costs of new loans	91	45	46
Attractiveness of financed investments	143	69	74
New loans for investments	143	69	74
Creditworthiness of financed investors	87	43	44
Payments for new loans	100	50	50
Risk of debt default	179	87	92
Loans for investments	32	16	16
Asset cash flow	0	0	0
Payments for loans	100	50	50
Liquidity of banks	179	87	92
Euphoria	55	27	28
Short sale	6	3	3
Risk of misbehaviour	53	26	27
Risk of contagion	124	59	65
Creditworthiness of banks	28	14	14
Uncertainty	119	57	62
Interbank lending	119	57	62
Foreign exchange rate	2	2	0
Money supply	118	57	61

Appendix 6_Involved elements of paths_From element 15 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	1	1	0
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	2	2	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	2	2	0
Interbank lending	2	2	0
Foreign exchange rate	2	2	0
Money supply	2	2	0

Appendix 6_Involved elements of paths_From element 16 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	64	31	33
Asset supply	82	41	41
Asset price	130	64	66
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	84	41	43
Attractiveness of asset	84	41	43
General rate of interest	24	12	12
Costs of new loans	130	64	66
Attractiveness of financed investments	65	32	33
New loans for investments	99	49	50
Creditworthiness of financed investors	130	64	66
Payments for new loans	96	48	48
Risk of debt default	115	57	58
Loans for investments	130	64	66
Asset cash flow	115	57	58
Payments for loans	96	48	48
Liquidity of banks	79	39	40
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	104	51	53
Creditworthiness of banks	58	28	30
Uncertainty	89	45	44
Interbank lending	89	45	44
Foreign exchange rate	24	12	12
Money supply	77	39	38

Appendix 6_Involved elements of paths_From element 16 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	84	38	46
Asset supply	52	26	26
Asset price	95	45	50
Expected risk of asset	3	2	1
Expected return of asset	74	34	40
Asset risk-return ratio	9	4	5
Market risk-return ratio	54	25	29
Attractiveness of asset	63	29	34
General rate of interest	26	16	10
Costs of new loans	126	60	66
Attractiveness of financed investments	107	51	56
New loans for investments	107	51	56
Creditworthiness of financed investors	126	60	66
Payments for new loans	76	37	39
Risk of debt default	122	58	64
Loans for investments	126	60	66
Asset cash flow	122	58	64
Payments for loans	76	37	39
Liquidity of banks	126	60	66
Euphoria	46	22	24
Short sale	18	9	9
Risk of misbehaviour	40	19	21
Risk of contagion	93	42	51
Creditworthiness of banks	11	3	8
Uncertainty	100	52	48
Interbank lending	100	52	48
Foreign exchange rate	18	12	6
Money supply	91	49	42

Appendix 6_Involved elements of paths_From element 16 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	40	24	16
Asset supply	48	24	24
Asset price	72	40	32
Expected risk of asset	0	0	0
Expected return of asset	72	40	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	40	28	12
Attractiveness of asset	40	28	12
General rate of interest	40	22	18
Costs of new loans	80	44	36
Attractiveness of financed investments	52	30	22
New loans for investments	66	34	32
Creditworthiness of financed investors	80	44	36
Payments for new loans	54	26	28
Risk of debt default	80	44	36
Loans for investments	80	44	36
Asset cash flow	80	44	36
Payments for loans	54	26	28
Liquidity of banks	62	32	30
Euphoria	36	20	16
Short sale	0	0	0
Risk of misbehaviour	36	20	16
Risk of contagion	64	36	28
Creditworthiness of banks	48	28	20
Uncertainty	80	44	36
Interbank lending	80	44	36
Foreign exchange rate	80	44	36
Money supply	80	44	36

Appendix 6_Involved elements of paths_From element 17 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	44	23	21
Asset supply	46	23	23
Asset price	73	38	35
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	40	21	19
Attractiveness of asset	40	21	19
General rate of interest	24	14	10
Costs of new loans	30	16	14
Attractiveness of financed investments	18	10	8
New loans for investments	39	20	19
Creditworthiness of financed investors	15	8	7
Payments for new loans	18	8	10
Risk of debt default	73	38	35
Loans for investments	0	0	0
Asset cash flow	73	38	35
Payments for loans	18	8	10
Liquidity of banks	51	26	25
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	60	31	29
Creditworthiness of banks	34	18	16
Uncertainty	50	26	24
Interbank lending	50	26	24
Foreign exchange rate	12	6	6
Money supply	44	23	21

Appendix 6_Involved elements of paths_From element 17 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	85	45	40
Asset supply	100	50	50
Asset price	162	83	79
Expected risk of asset	1	0	1
Expected return of asset	104	54	50
Asset risk-return ratio	3	2	1
Market risk-return ratio	120	59	61
Attractiveness of asset	123	61	62
General rate of interest	38	22	16
Costs of new loans	91	46	45
Attractiveness of financed investments	143	74	69
New loans for investments	143	74	69
Creditworthiness of financed investors	87	44	43
Payments for new loans	100	50	50
Risk of debt default	179	92	87
Loans for investments	32	16	16
Asset cash flow	179	92	87
Payments for loans	100	50	50
Liquidity of banks	179	92	87
Euphoria	55	28	27
Short sale	6	3	3
Risk of misbehaviour	53	27	26
Risk of contagion	124	65	59
Creditworthiness of banks	28	14	14
Uncertainty	119	62	57
Interbank lending	119	62	57
Foreign exchange rate	2	0	2
Money supply	118	61	57

Appendix 6_Involved elements of paths_From element 17 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	1	0	1
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	2	0	2
Loans for investments	0	0	0
Asset cash flow	2	0	2
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	2	0	2
Interbank lending	2	0	2
Foreign exchange rate	2	0	2
Money supply	2	0	2

Appendix 6_Involved elements of paths_From element 18 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	60	28	32
Asset supply	70	35	35
Asset price	111	54	57
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	68	31	37
Attractiveness of asset	68	31	37
General rate of interest	24	13	11
Costs of new loans	46	22	24
Attractiveness of financed investments	46	22	24
New loans for investments	80	39	41
Creditworthiness of financed investors	40	20	20
Payments for new loans	0	0	0
Risk of debt default	99	47	52
Loans for investments	34	18	16
Asset cash flow	99	47	52
Payments for loans	111	54	57
Liquidity of banks	70	34	36
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	88	42	46
Creditworthiness of banks	46	21	25
Uncertainty	73	37	36
Interbank lending	73	37	36
Foreign exchange rate	18	10	8
Money supply	64	33	31

Appendix 6_Involved elements of paths_From element 18 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	85	40	45
Asset supply	60	30	30
Asset price	105	52	53
Expected risk of asset	2	1	1
Expected return of asset	72	36	36
Asset risk-return ratio	6	3	3
Market risk-return ratio	62	28	34
Attractiveness of asset	68	31	37
General rate of interest	28	16	12
Costs of new loans	73	38	35
Attractiveness of financed investments	111	56	55
New loans for investments	111	56	55
Creditworthiness of financed investors	71	37	34
Payments for new loans	0	0	0
Risk of debt default	127	63	64
Loans for investments	50	27	23
Asset cash flow	127	63	64
Payments for loans	130	65	65
Liquidity of banks	130	65	65
Euphoria	42	21	21
Short sale	12	6	6
Risk of misbehaviour	38	19	19
Risk of contagion	95	45	50
Creditworthiness of banks	13	6	7
Uncertainty	99	50	49
Interbank lending	99	50	49
Foreign exchange rate	16	6	10
Money supply	91	45	46

Appendix 6_Involved elements of paths_From element 18 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	38	18	20
Asset supply	44	22	22
Asset price	66	32	34
Expected risk of asset	0	0	0
Expected return of asset	60	28	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	36	28	8
Attractiveness of asset	36	28	8
General rate of interest	36	17	19
Costs of new loans	32	12	20
Attractiveness of financed investments	44	20	24
New loans for investments	58	24	34
Creditworthiness of financed investors	32	12	20
Payments for new loans	0	0	0
Risk of debt default	72	34	38
Loans for investments	26	8	18
Asset cash flow	72	34	38
Payments for loans	72	34	38
Liquidity of banks	56	28	28
Euphoria	30	14	16
Short sale	0	0	0
Risk of misbehaviour	30	14	16
Risk of contagion	58	32	26
Creditworthiness of banks	42	24	18
Uncertainty	72	34	38
Interbank lending	72	34	38
Foreign exchange rate	72	34	38
Money supply	72	34	38

Appendix 6_Involved elements of paths_From element 19 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	25	13	12
Asset supply	34	17	17
Asset price	54	27	27
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	39	19	20
Attractiveness of asset	39	19	20
General rate of interest	9	3	6
Costs of new loans	16	8	8
Attractiveness of financed investments	0	0	0
New loans for investments	51	26	25
Creditworthiness of financed investors	16	8	8
Payments for new loans	32	16	16
Risk of debt default	48	24	24
Loans for investments	16	8	8
Asset cash flow	48	24	24
Payments for loans	32	16	16
Liquidity of banks	54	27	27
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	38	19	19
Creditworthiness of banks	12	6	6
Uncertainty	30	14	16
Interbank lending	30	14	16
Foreign exchange rate	0	0	0
Money supply	30	14	16

Appendix 6_Involved elements of paths_From element 19 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	40	18	22
Asset supply	56	28	28
Asset price	84	40	44
Expected risk of asset	0	0	0
Expected return of asset	60	28	32
Asset risk-return ratio	0	0	0
Market risk-return ratio	50	30	20
Attractiveness of asset	50	30	20
General rate of interest	45	22	23
Costs of new loans	38	18	20
Attractiveness of financed investments	48	22	26
New loans for investments	72	32	40
Creditworthiness of financed investors	38	18	20
Payments for new loans	46	20	26
Risk of debt default	90	44	46
Loans for investments	14	6	8
Asset cash flow	90	44	46
Payments for loans	46	20	26
Liquidity of banks	90	44	46
Euphoria	30	14	16
Short sale	0	0	0
Risk of misbehaviour	30	14	16
Risk of contagion	78	40	38
Creditworthiness of banks	66	34	32
Uncertainty	90	44	46
Interbank lending	90	44	46
Foreign exchange rate	90	44	46
Money supply	90	44	46

Appendix 6_Involved elements of paths_From element 20 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	102	54	48
Asset supply	123	63	60
Asset price	194	101	93
Expected risk of asset	0	0	0
Expected return of asset	181	94	87
Asset risk-return ratio	6	4	2
Market risk-return ratio	118	62	56
Attractiveness of asset	124	66	58
General rate of interest	48	25	23
Costs of new loans	71	37	34
Attractiveness of financed investments	120	62	58
New loans for investments	153	78	75
Creditworthiness of financed investors	53	27	26
Payments for new loans	94	46	48
Risk of debt default	175	90	85
Loans for investments	35	17	18
Asset cash flow	175	90	85
Payments for loans	94	46	48
Liquidity of banks	114	58	56
Euphoria	194	101	93
Short sale	13	7	6
Risk of misbehaviour	0	0	0
Risk of contagion	161	83	78
Creditworthiness of banks	94	49	45
Uncertainty	131	66	65
Interbank lending	131	66	65
Foreign exchange rate	30	14	16
Money supply	116	58	58

Appendix 6_Involved elements of paths_From element 20 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	286	150	136
Asset supply	268	135	133
Asset price	396	201	195
Expected risk of asset	5	2	3
Expected return of asset	361	184	177
Asset risk-return ratio	72	37	35
Market risk-return ratio	127	64	63
Attractiveness of asset	199	101	98
General rate of interest	94	43	51
Costs of new loans	320	161	159
Attractiveness of financed investments	331	169	162
New loans for investments	331	169	162
Creditworthiness of financed investors	298	150	148
Payments for new loans	278	138	140
Risk of debt default	400	202	198
Loans for investments	42	21	21
Asset cash flow	400	202	198
Payments for loans	278	138	140
Liquidity of banks	448	227	221
Euphoria	448	227	221
Short sale	244	124	120
Risk of misbehaviour	149	76	73
Risk of contagion	282	148	134
Creditworthiness of banks	37	21	16
Uncertainty	304	149	155
Interbank lending	304	149	155
Foreign exchange rate	88	40	48
Money supply	260	125	135

Appendix 6_Involved elements of paths_From element 20 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	102	50	52
Asset supply	90	46	44
Asset price	118	58	60
Expected risk of asset	6	2	4
Expected return of asset	94	48	46
Asset risk-return ratio	48	26	22
Market risk-return ratio	22	10	12
Attractiveness of asset	70	36	34
General rate of interest	69	34	35
Costs of new loans	88	44	44
Attractiveness of financed investments	70	34	36
New loans for investments	114	60	54
Creditworthiness of financed investors	88	44	44
Payments for new loans	94	52	42
Risk of debt default	138	68	70
Loans for investments	20	12	8
Asset cash flow	138	68	70
Payments for loans	94	52	42
Liquidity of banks	50	28	22
Euphoria	138	68	70
Short sale	88	44	44
Risk of misbehaviour	44	22	22
Risk of contagion	80	40	40
Creditworthiness of banks	6	2	4
Uncertainty	138	68	70
Interbank lending	138	68	70
Foreign exchange rate	138	68	70
Money supply	138	68	70

Appendix 6_Involved elements of paths_From element 21 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	12	6	6
Asset supply	9	4	5
Asset price	13	6	7
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	7	3	4
Attractiveness of asset	7	3	4
General rate of interest	3	1	2
Costs of new loans	3	1	2
Attractiveness of financed investments	0	0	0
New loans for investments	9	4	5
Creditworthiness of financed investors	3	1	2
Payments for new loans	6	2	4
Risk of debt default	9	4	5
Loans for investments	3	1	2
Asset cash flow	9	4	5
Payments for loans	6	2	4
Liquidity of banks	9	4	5
Euphoria	0	0	0
Short sale	13	6	7
Risk of misbehaviour	0	0	0
Risk of contagion	11	5	6
Creditworthiness of banks	0	0	0
Uncertainty	9	4	5
Interbank lending	9	4	5
Foreign exchange rate	0	0	0
Money supply	9	4	5

Appendix 6_Involved elements of paths_From element 21 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	273	130	143
Asset supply	272	135	137
Asset price	374	183	191
Expected risk of asset	1	1	0
Expected return of asset	288	140	148
Asset risk-return ratio	3	1	2
Market risk-return ratio	91	49	42
Attractiveness of asset	94	50	44
General rate of interest	89	43	46
Costs of new loans	209	102	107
Attractiveness of financed investments	279	136	143
New loans for investments	279	136	143
Creditworthiness of financed investors	175	86	89
Payments for new loans	216	108	108
Risk of debt default	332	164	168
Loans for investments	56	28	28
Asset cash flow	332	164	168
Payments for loans	216	108	108
Liquidity of banks	375	184	191
Euphoria	144	70	74
Short sale	375	184	191
Risk of misbehaviour	145	71	74
Risk of contagion	237	115	122
Creditworthiness of banks	22	11	11
Uncertainty	254	126	128
Interbank lending	254	126	128
Foreign exchange rate	88	44	44
Money supply	210	104	106

Appendix 6_Involved elements of paths_From element 21 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	96	48	48
Asset supply	90	44	46
Asset price	114	56	58
Expected risk of asset	6	4	2
Expected return of asset	76	36	40
Asset risk-return ratio	18	8	10
Market risk-return ratio	24	12	12
Attractiveness of asset	42	20	22
General rate of interest	60	30	30
Costs of new loans	56	28	28
Attractiveness of financed investments	64	32	32
New loans for investments	96	48	48
Creditworthiness of financed investors	56	28	28
Payments for new loans	72	36	36
Risk of debt default	120	60	60
Loans for investments	24	12	12
Asset cash flow	120	60	60
Payments for loans	72	36	36
Liquidity of banks	32	16	16
Euphoria	38	18	20
Short sale	120	60	60
Risk of misbehaviour	44	22	22
Risk of contagion	72	36	36
Creditworthiness of banks	0	0	0
Uncertainty	120	60	60
Interbank lending	120	60	60
Foreign exchange rate	120	60	60
Money supply	120	60	60

Appendix 6_Involved elements of paths_From element 22 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	95	50	45
Asset supply	116	58	58
Asset price	187	96	91
Expected risk of asset	6	2	4
Expected return of asset	181	94	87
Asset risk-return ratio	12	6	6
Market risk-return ratio	111	58	53
Attractiveness of asset	123	64	59
General rate of interest	45	23	22
Costs of new loans	69	36	33
Attractiveness of financed investments	120	62	58
New loans for investments	147	75	72
Creditworthiness of financed investors	51	26	25
Payments for new loans	90	44	46
Risk of debt default	169	87	82
Loans for investments	33	16	17
Asset cash flow	169	87	82
Payments for loans	90	44	46
Liquidity of banks	108	55	53
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	187	96	91
Risk of contagion	154	79	75
Creditworthiness of banks	94	49	45
Uncertainty	125	63	62
Interbank lending	125	63	62
Foreign exchange rate	30	14	16
Money supply	110	55	55

Appendix 6_Involved elements of paths_From element 22 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	239	124	115
Asset supply	221	112	109
Asset price	349	178	171
Expected risk of asset	175	90	85
Expected return of asset	334	171	163
Asset risk-return ratio	242	124	118
Market risk-return ratio	79	42	37
Attractiveness of asset	321	166	155
General rate of interest	80	39	41
Costs of new loans	286	147	139
Attractiveness of financed investments	296	150	146
New loans for investments	296	150	146
Creditworthiness of financed investors	268	136	132
Payments for new loans	248	125	123
Risk of debt default	358	184	174
Loans for investments	37	18	19
Asset cash flow	358	184	174
Payments for loans	248	125	123
Liquidity of banks	401	204	197
Euphoria	122	64	58
Short sale	28	14	14
Risk of misbehaviour	401	204	197
Risk of contagion	235	121	114
Creditworthiness of banks	37	20	17
Uncertainty	266	133	133
Interbank lending	266	133	133
Foreign exchange rate	74	36	38
Money supply	229	114	115

Appendix 6_Involved elements of paths_From element 22 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	92	44	48
Asset supply	80	40	40
Asset price	108	52	56
Expected risk of asset	66	32	34
Expected return of asset	86	42	44
Asset risk-return ratio	108	54	54
Market risk-return ratio	6	2	4
Attractiveness of asset	114	56	58
General rate of interest	64	31	33
Costs of new loans	80	36	44
Attractiveness of financed investments	60	26	34
New loans for investments	108	50	58
Creditworthiness of financed investors	80	36	44
Payments for new loans	88	38	50
Risk of debt default	128	62	66
Loans for investments	20	8	12
Asset cash flow	128	62	66
Payments for loans	88	38	50
Liquidity of banks	54	26	28
Euphoria	36	18	18
Short sale	24	12	12
Risk of misbehaviour	128	62	66
Risk of contagion	70	34	36
Creditworthiness of banks	6	2	4
Uncertainty	128	62	66
Interbank lending	128	62	66
Foreign exchange rate	128	62	66
Money supply	128	62	66

Appendix 6_Involved elements of paths_From element 23 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	8	4	4
Asset supply	8	4	4
Asset price	19	10	9
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	14	8	6
Attractiveness of asset	14	8	6
General rate of interest	6	4	2
Costs of new loans	5	3	2
Attractiveness of financed investments	0	0	0
New loans for investments	16	8	8
Creditworthiness of financed investors	5	3	2
Payments for new loans	10	6	4
Risk of debt default	15	8	7
Loans for investments	5	3	2
Asset cash flow	15	8	7
Payments for loans	10	6	4
Liquidity of banks	16	8	8
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	19	10	9
Creditworthiness of banks	0	0	0
Uncertainty	15	8	7
Interbank lending	15	8	7
Foreign exchange rate	0	0	0
Money supply	15	8	7

Appendix 6_Involved elements of paths_From element 23 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	69	31	38
Asset supply	138	69	69
Asset price	207	100	107
Expected risk of asset	0	0	0
Expected return of asset	162	78	84
Asset risk-return ratio	0	0	0
Market risk-return ratio	138	62	76
Attractiveness of asset	138	62	76
General rate of interest	57	26	31
Costs of new loans	123	58	65
Attractiveness of financed investments	156	77	79
New loans for investments	156	77	79
Creditworthiness of financed investors	99	48	51
Payments for new loans	126	63	63
Risk of debt default	180	86	94
Loans for investments	30	16	14
Asset cash flow	180	86	94
Payments for loans	126	63	63
Liquidity of banks	208	100	108
Euphoria	81	39	42
Short sale	0	0	0
Risk of misbehaviour	81	39	42
Risk of contagion	208	100	108
Creditworthiness of banks	0	0	0
Uncertainty	156	76	80
Interbank lending	156	76	80
Foreign exchange rate	66	32	34
Money supply	123	59	64

Appendix 6_Involved elements of paths_From element 23 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	30	18	12
Asset supply	48	24	24
Asset price	78	42	36
Expected risk of asset	0	0	0
Expected return of asset	52	28	24
Asset risk-return ratio	0	0	0
Market risk-return ratio	48	24	24
Attractiveness of asset	48	24	24
General rate of interest	42	22	20
Costs of new loans	40	22	18
Attractiveness of financed investments	48	26	22
New loans for investments	66	38	28
Creditworthiness of financed investors	40	22	18
Payments for new loans	48	28	20
Risk of debt default	84	44	40
Loans for investments	14	8	6
Asset cash flow	84	44	40
Payments for loans	48	28	20
Liquidity of banks	18	12	6
Euphoria	26	14	12
Short sale	0	0	0
Risk of misbehaviour	26	14	12
Risk of contagion	84	44	40
Creditworthiness of banks	0	0	0
Uncertainty	84	44	40
Interbank lending	84	44	40
Foreign exchange rate	84	44	40
Money supply	84	44	40

Appendix 6_Involved elements of paths_From element 24 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	8	4	4
Asset supply	8	4	4
Asset price	19	9	10
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	14	6	8
Attractiveness of asset	14	6	8
General rate of interest	6	2	4
Costs of new loans	5	2	3
Attractiveness of financed investments	0	0	0
New loans for investments	16	8	8
Creditworthiness of financed investors	5	2	3
Payments for new loans	10	4	6
Risk of debt default	15	7	8
Loans for investments	5	2	3
Asset cash flow	15	7	8
Payments for loans	10	4	6
Liquidity of banks	16	8	8
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	19	9	10
Creditworthiness of banks	19	9	10
Uncertainty	15	7	8
Interbank lending	15	7	8
Foreign exchange rate	0	0	0
Money supply	15	7	8

Appendix 6_Involved elements of paths_From element 24 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	69	38	31
Asset supply	138	69	69
Asset price	207	107	100
Expected risk of asset	0	0	0
Expected return of asset	162	84	78
Asset risk-return ratio	0	0	0
Market risk-return ratio	138	76	62
Attractiveness of asset	138	76	62
General rate of interest	57	31	26
Costs of new loans	123	65	58
Attractiveness of financed investments	156	79	77
New loans for investments	156	79	77
Creditworthiness of financed investors	99	51	48
Payments for new loans	126	63	63
Risk of debt default	180	94	86
Loans for investments	30	14	16
Asset cash flow	180	94	86
Payments for loans	126	63	63
Liquidity of banks	208	108	100
Euphoria	81	42	39
Short sale	0	0	0
Risk of misbehaviour	81	42	39
Risk of contagion	208	108	100
Creditworthiness of banks	208	108	100
Uncertainty	156	80	76
Interbank lending	156	80	76
Foreign exchange rate	66	34	32
Money supply	123	64	59

Appendix 6_Involved elements of paths_From element 24 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	30	12	18
Asset supply	48	24	24
Asset price	78	36	42
Expected risk of asset	0	0	0
Expected return of asset	52	24	28
Asset risk-return ratio	0	0	0
Market risk-return ratio	48	24	24
Attractiveness of asset	48	24	24
General rate of interest	42	20	22
Costs of new loans	40	18	22
Attractiveness of financed investments	48	22	26
New loans for investments	66	28	38
Creditworthiness of financed investors	40	18	22
Payments for new loans	48	20	28
Risk of debt default	84	40	44
Loans for investments	14	6	8
Asset cash flow	84	40	44
Payments for loans	48	20	28
Liquidity of banks	18	6	12
Euphoria	26	12	14
Short sale	0	0	0
Risk of misbehaviour	26	12	14
Risk of contagion	84	40	44
Creditworthiness of banks	84	40	44
Uncertainty	84	40	44
Interbank lending	84	40	44
Foreign exchange rate	84	40	44
Money supply	84	40	44

Appendix 6_Involved elements of paths_From element 25 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	65	31	34
Asset supply	96	48	48
Asset price	148	72	76
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	92	44	48
Attractiveness of asset	92	44	48
General rate of interest	68	32	36
Costs of new loans	65	31	34
Attractiveness of financed investments	21	10	11
New loans for investments	117	57	60
Creditworthiness of financed investors	24	12	12
Payments for new loans	77	37	40
Risk of debt default	98	48	50
Loans for investments	24	12	12
Asset cash flow	98	48	50
Payments for loans	77	37	40
Liquidity of banks	117	57	60
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	137	67	70
Creditworthiness of banks	70	34	36
Uncertainty	148	72	76
Interbank lending	148	72	76
Foreign exchange rate	48	26	22
Money supply	124	61	63

Appendix 6_Involved elements of paths_From element 25 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	164	76	88
Asset supply	168	84	84
Asset price	320	155	165
Expected risk of asset	1	1	0
Expected return of asset	250	120	130
Asset risk-return ratio	3	1	2
Market risk-return ratio	248	123	125
Attractiveness of asset	251	124	127
General rate of interest	130	60	70
Costs of new loans	215	105	110
Attractiveness of financed investments	258	124	134
New loans for investments	258	124	134
Creditworthiness of financed investors	189	97	92
Payments for new loans	198	99	99
Risk of debt default	218	106	112
Loans for investments	40	20	20
Asset cash flow	218	106	112
Payments for loans	198	99	99
Liquidity of banks	337	163	174
Euphoria	128	62	66
Short sale	6	3	3
Risk of misbehaviour	126	61	65
Risk of contagion	245	115	130
Creditworthiness of banks	66	30	36
Uncertainty	337	163	174
Interbank lending	337	163	174
Foreign exchange rate	2	2	0
Money supply	336	163	173

Appendix 6_Involved elements of paths_From element 25 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	1	1	0
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	0	0	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	2	2	0
Interbank lending	2	2	0
Foreign exchange rate	2	2	0
Money supply	2	2	0

Appendix 6_Involved elements of paths_From element 26 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	65	34	31
Asset supply	96	48	48
Asset price	148	76	72
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	92	48	44
Attractiveness of asset	92	48	44
General rate of interest	68	36	32
Costs of new loans	65	34	31
Attractiveness of financed investments	21	11	10
New loans for investments	117	60	57
Creditworthiness of financed investors	24	12	12
Payments for new loans	77	40	37
Risk of debt default	98	50	48
Loans for investments	24	12	12
Asset cash flow	98	50	48
Payments for loans	77	40	37
Liquidity of banks	117	60	57
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	137	70	67
Creditworthiness of banks	70	36	34
Uncertainty	0	0	0
Interbank lending	148	76	72
Foreign exchange rate	48	22	26
Money supply	124	63	61

Appendix 6_Involved elements of paths_From element 26 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	164	88	76
Asset supply	168	84	84
Asset price	320	165	155
Expected risk of asset	1	0	1
Expected return of asset	250	130	120
Asset risk-return ratio	3	2	1
Market risk-return ratio	248	125	123
Attractiveness of asset	251	127	124
General rate of interest	130	70	60
Costs of new loans	215	110	105
Attractiveness of financed investments	258	134	124
New loans for investments	258	134	124
Creditworthiness of financed investors	189	92	97
Payments for new loans	198	99	99
Risk of debt default	218	112	106
Loans for investments	40	20	20
Asset cash flow	218	112	106
Payments for loans	198	99	99
Liquidity of banks	337	174	163
Euphoria	128	66	62
Short sale	6	3	3
Risk of misbehaviour	126	65	61
Risk of contagion	245	130	115
Creditworthiness of banks	66	36	30
Uncertainty	0	0	0
Interbank lending	337	174	163
Foreign exchange rate	2	0	2
Money supply	336	173	163

Appendix 6_Involved elements of paths_From element 26 to element 27

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	1	0	1
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	0	0	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	0	0	0
Interbank lending	2	0	2
Foreign exchange rate	2	0	2
Money supply	2	0	2

Appendix 6_Involved elements of paths_From element 27 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	25	13	12
Asset supply	34	17	17
Asset price	54	27	27
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	39	19	20
Attractiveness of asset	39	19	20
General rate of interest	9	3	6
Costs of new loans	16	8	8
Attractiveness of financed investments	0	0	0
New loans for investments	51	26	25
Creditworthiness of financed investors	16	8	8
Payments for new loans	32	16	16
Risk of debt default	48	24	24
Loans for investments	16	8	8
Asset cash flow	48	24	24
Payments for loans	32	16	16
Liquidity of banks	54	27	27
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	38	19	19
Creditworthiness of banks	12	6	6
Uncertainty	30	14	16
Interbank lending	30	14	16
Foreign exchange rate	54	27	27
Money supply	30	14	16

Appendix 6_Involved elements of paths_From element 27 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	0	0	0
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	0	0	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	1	1	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	0	0	0
Interbank lending	0	0	0
Foreign exchange rate	1	1	0
Money supply	0	0	0

Appendix 6_Involved elements of paths_From element 28 to element 3

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	61	31	30
Asset supply	88	44	44
Asset price	136	69	67
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	84	42	42
Attractiveness of asset	84	42	42
General rate of interest	80	42	38
Costs of new loans	71	36	35
Attractiveness of financed investments	27	14	13
New loans for investments	105	53	52
Creditworthiness of financed investors	18	8	10
Payments for new loans	74	37	37
Risk of debt default	92	46	46
Loans for investments	18	8	10
Asset cash flow	92	46	46
Payments for loans	74	37	37
Liquidity of banks	105	53	52
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	125	63	62
Creditworthiness of banks	67	34	33
Uncertainty	12	6	6
Interbank lending	12	6	6
Foreign exchange rate	48	22	26
Money supply	136	69	67

Appendix 6_Involved elements of paths_From element 28 to element 19

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	225	120	105
Asset supply	238	119	119
Asset price	436	225	211
Expected risk of asset	1	0	1
Expected return of asset	336	174	162
Asset risk-return ratio	3	2	1
Market risk-return ratio	338	170	168
Attractiveness of asset	341	172	169
General rate of interest	172	94	78
Costs of new loans	274	140	134
Attractiveness of financed investments	346	177	169
New loans for investments	346	177	169
Creditworthiness of financed investors	239	116	123
Payments for new loans	260	126	134
Risk of debt default	337	174	163
Loans for investments	60	28	32
Asset cash flow	337	174	163
Payments for loans	260	126	134
Liquidity of banks	455	235	220
Euphoria	171	88	83
Short sale	6	3	3
Risk of misbehaviour	169	87	82
Risk of contagion	304	160	144
Creditworthiness of banks	66	36	30
Uncertainty	119	62	57
Interbank lending	119	62	57
Foreign exchange rate	2	0	2
Money supply	455	235	220

Element	Overall number of paths	Positive paths	Negative paths
Asset demand	0	0	0
Asset supply	0	0	0
Asset price	0	0	0
Expected risk of asset	0	0	0
Expected return of asset	0	0	0
Asset risk-return ratio	0	0	0
Market risk-return ratio	0	0	0
Attractiveness of asset	0	0	0
General rate of interest	1	0	1
Costs of new loans	0	0	0
Attractiveness of financed investments	0	0	0
New loans for investments	0	0	0
Creditworthiness of financed investors	0	0	0
Payments for new loans	0	0	0
Risk of debt default	0	0	0
Loans for investments	0	0	0
Asset cash flow	0	0	0
Payments for loans	0	0	0
Liquidity of banks	0	0	0
Euphoria	0	0	0
Short sale	0	0	0
Risk of misbehaviour	0	0	0
Risk of contagion	0	0	0
Creditworthiness of banks	0	0	0
Uncertainty	0	0	0
Interbank lending	0	0	0
Foreign exchange rate	2	0	2
Money supply	2	0	2

Appendix 7:

Link of literature to research objectives, questions and activities

This chapter shows the link between the literature of the study and the research objectives, research questions and research activities which are described in Chapter 3.

The first column contains the literature and the remaining columns describe research objectives, research questions and research activities. Existing links between both are highlighted in grey.

Abbreviation	Description
Research objective 1	Development of systemic financial crisis model
Research activity 1-1	Identification of systemic modelling and analyses options
Research activity 1-2	Definition of financial crises
Research activity 1-3	Description of stages of financial crises
Research activity 1-4	Systemic modelling of the price theory
Research activity 1-5	Systemic modelling of the asset price theory
Research activity 1-6	Systemic modelling of credit leverage
Research activity 1-7	Systemic modelling of creditworthiness
Research activity 1-8	Systemic modelling of credit cash flow
Research activity 1-9	Systemic modelling of principal payments
Research activity 1-10	Identification of non-rational market behaviour
Research activity 1-11	Systemic modelling of speculation
Research activity 1-12	Systemic modelling of price correction mechanisms
Research activity 1-13	Systemic modelling of herd behaviour
Research activity 1-14	Systemic modelling of moral hazard
Research activity 1-15	Systemic modelling of fraud
Research activity 1-16	Identification of reasons for exuberated prices
Research activity 1-17	Identification of consequences of over-indebtedness
Research activity 1-18	Systemic modelling of contagion
Research activity 1-19	Systemic modelling of bank runs
Research activity 1-20	Definition of financial crisis containment actions
Research activity 1-21	Identification of systemic consequences of central banks
Research activity 1-22	Identification of systemic consequences of the lender of last resort
Research activity 1-23	Identification of systemic consequences of governments and regulators

Abbreviation	Description
Research objective 2	Analysis of financial crisis containment actions
Research question 2-1	How effective are the crisis containment actions of central banks?
Research activity 2-1-1	Analysis of the effectiveness of the extension of money supply
Research activity 2-1-2	Analysis of the effectiveness of the increasing of general interest rate
Research activity 2-1-3	Analysis of the effectiveness of the decreasing of general interest rate
Research activity 2-1-4	Analysis of the effectiveness of the appreciation of domestic currency
Research activity 2-1-5	Analysis of the effectiveness of the depreciation of domestic currency
Research activity 2-1-6	Analysis of the effectiveness of asset purchases from markets
Research activity 2-1-7	Analysis of the effectiveness of asset purchases from banks
Research activity 2-1-8	Analysis of the effectiveness of the lightening of collateral requirements
Research question 2-2	How effective are the containment efforts of the lenders of last resort?
Research activity 2-2-1	Analysis of the effectiveness of the provision of liquidity to banks
Research activity 2-2-2	Analysis of the effectiveness of the provision of liquidity to financed investors
Research activity 2-2-3	Analysis of the effectiveness of the provision of foreign liquidity to banks
Research question 2-3	How effective are the crisis containment actions of governments and regulators?
Research activity 2-3-1	Analysis of the effectiveness of deposit insurances, guarantees and nationalisations
Research activity 2-3-2	Analysis of the effectiveness of asset purchases programme
Research activity 2-3-3	Analysis of the effectiveness of asset transfer programme
Research activity 2-3-4	Analysis of the effectiveness of the debt moratorium for financed investors
Research activity 2-3-5	Analysis of the effectiveness of the accounting discretion
Research activity 2-3-6	Analysis of the effectiveness of deposit freezing or bank holidays
Research activity 2-3-7	Analysis of the effectiveness of bank holidays on exchanges
Research activity 2-3-8	Analysis of the effectiveness of stress tests
Research activity 2-3-9	Analysis of the effectiveness of the prohibition of short sales
Research question 2-4	Which potential new containment actions might be effective?
Research question 2-5	Which combination of financial crisis actions causes interferences?
Research objective 3	Historical evaluation of results
Research question 3-1	To what extent do the results of the complex system analysis of financial crisis actions conform to successful historic market interventions?
Research activity 3-1-1	Selection of financial crises
Research activity 3-1-2	Collection of required information
Research activity 3-1-3	Analysis of historical information
Methodology	Philosophy, research approach and complex systems
Further research	Literature which might be considered in extended studies

Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research objective 1	Research activity 1-1	Research activity 1-2	Research activity 1-3	Research activity 1-4	Research activity 1-5	Research activity 1-6	Research activity 1-7	Research activity 1-8	Research activity 1-9	Research activity 1-10	Research activity 1-11	Research activity 1-12	Research activity 1-13	Research activity 1-14	Research activity 1-15	Research activity 1-16	Research activity 1-17	Research activity 1-18	Research activity 1-19	Research activity 1-20	Research activity 1-21	Research activity 1-22	Research activity 1-23	Research objective 2	Research question 2-1	Research activity 2-1-1	Research activity 2-1-2	Research activity 2-1-3
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Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research objective 1	Research activity 1-1	Research activity 1-2	Research activity 1-3	Research activity 1-4	Research activity 1-5	Research activity 1-6	Research activity 1-7	Research activity 1-8	Research activity 1-9	Research activity 1-10	Research activity 1-11	Research activity 1-12	Research activity 1-13	Research activity 1-14	Research activity 1-15	Research activity 1-16	Research activity 1-17	Research activity 1-18	Research activity 1-19	Research activity 1-20	Research activity 1-21	Research activity 1-22	Research activity 1-23	Research objective 2	Research question 2-1	Research activity 2-1-1	Research activity 2-1-2	Research activity 2-1-3
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Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research objective 1	Research activity 1-1	Research activity 1-2	Research activity 1-3	Research activity 1-4	Research activity 1-5	Research activity 1-6	Research activity 1-7	Research activity 1-8	Research activity 1-9	Research activity 1-10	Research activity 1-11	Research activity 1-12	Research activity 1-13	Research activity 1-14	Research activity 1-15	Research activity 1-16	Research activity 1-17	Research activity 1-18	Research activity 1-19	Research activity 1-20	Research activity 1-21	Research activity 1-22	Research activity 1-23	Research objective 2	Research question 2-1	Research activity 2-1-1	Research activity 2-1-2	Research activity 2-1-3
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Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research objective 1	Research activity 1-1	Research activity 1-2	Research activity 1-3	Research activity 1-4	Research activity 1-5	Research activity 1-6	Research activity 1-7	Research activity 1-8	Research activity 1-9	Research activity 1-10	Research activity 1-11	Research activity 1-12	Research activity 1-13	Research activity 1-14	Research activity 1-15	Research activity 1-16	Research activity 1-17	Research activity 1-18	Research activity 1-19	Research activity 1-20	Research activity 1-21	Research activity 1-22	Research activity 1-23	Research objective 2	Research question 2-1	Research activity 2-1-1	Research activity 2-1-2	Research activity 2-1-3
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Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research objective 1	Research activity 1-1	Research activity 1-2	Research activity 1-3	Research activity 1-4	Research activity 1-5	Research activity 1-6	Research activity 1-7	Research activity 1-8	Research activity 1-9	Research activity 1-10	Research activity 1-11	Research activity 1-12	Research activity 1-13	Research activity 1-14	Research activity 1-15	Research activity 1-16	Research activity 1-17	Research activity 1-18	Research activity 1-19	Research activity 1-20	Research activity 1-21	Research activity 1-22	Research activity 1-23	Research objective 2	Research question 2-1	Research activity 2-1-1	Research activity 2-1-2	Research activity 2-1-3
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Appendix 7_Link of literature to research objectives, questions and activities

Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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Literature	Research activity 2-1-4	Research activity 2-1-5	Research activity 2-1-6	Research activity 2-1-7	Research activity 2-1-8	Research question 2-2	Research activity 2-2-1	Research activity 2-2-2	Research activity 2-2-3	Research question 2-3	Research activity 2-3-1	Research activity 2-3-2	Research activity 2-3-3	Research activity 2-3-4	Research activity 2-3-5	Research activity 2-3-6	Research activity 2-3-7	Research activity 2-3-8	Research activity 2-3-9	Research question 2-4	Research question 2-5	Research objective 3	Research question 3-1	Research activity 3-1-1	Research activity 3-1-2	Research activity 3-1-3	Methodology	Further research
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