THE PROBABILITIES OF THE TRANSITIONS BETWEEN THE INTERLOCKING DIRECTORATES' STATES BASED ON MARKOV CHAINS

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Abstract: The article analyzes the process of changes in the interlocking directorates network using Markov chains. The probabilities of company transitions between three specific states of networking, i.e. isolation, networking outside the largest component, and networking inside the largest component, were estimated. In addition, the average probabilities of transitions between states in the next 6 quarter periods, constant probabilities of transitions independent of the initial state of the process, and the expected time of return of the chain to individual states were estimated. Regardless of the initial state of networking of the enterprise, the highest probability was obtained for the process to be found in the state of connection with the largest component.

Keywords: interlocking directorates, network strategy, Markov Chain, probability of transition, estimated return time for Markov Chain.

1. Introduction

Relationships between companies may arise as a result of interlocking directorates, which Pfeffer and Salancik (2003/1978) describe as a form of interorganizational linkage that facilitates interaction between the organizations over time. This is a situation in which an inter-organizational network connection emerges. The subject of the work is related to a network of connections created through interlocking directorates, where the connection between companies is formed in a situation where at least one person is a member of the board of two companies (Mizruchi, 1996). Interlocking directorates are an important topic in organizational and management studies (Lamb, 2017). Interlocking board networks are thought to compromise the effectiveness of corporate governance (Wong, et al., 2015). Fich and Shivdasani (2006) found that corporations that have ties with other firms in interlocking board networks are associated with weak governance. Interlocking board linkages have important economic consequences for corporations and shareholders (Martin, et al., 2015; Withers, et al., 2018; Zona, et al., 2017).

The literature on the subject includes several theoretical constructions explaining the existence of interlocking directorates. They can be divided into two trends, where the subject of interlocking arises as a result of relations between directors due to personal benefits or bonds between organizations. Relationships between individuals are models of career advancement (Stokman, et al., 1988; Zajac, 1988; Perry, and Peyer, 2005), class hegemony (social cohesion) (Zeitlin, 1974; Useem, 1979, 1984; Burt, 1980; Palmer, 1983), or management control (Koenig, et al., 1979). Interorganizational relations include collusion models (Pennings, 1980; Burt, 1983), resource dependence (Pfeffer, 1972; Pennings, 1980; Pfeffer, 1987; Pfeffer, and Salancik, 2003/1978), legitimacy (Mizruchi, 1996), financial control (Dooley, 1969; Mariolis, 1975; Richardson, 1987; Mizruchi, and Stearns, 1988, 1994; Lang, and Lockhart, 1990), or reciprocity (Allen, 1974; Schoorman, et al., 1981). Each of these models can be a separate cause of interlocking at a specific time, or as a combination of several models at the same time. The strategy of establishing business connections using the board of directors is described as the most flexible and the most easily implemented (Pfeffer, and Salancik, 2003/1978), and the most widely used strategy in the area of the external environment of the company (Bazerman, and Schoorman, 1983; Yang, and Cai, 2011). This is due to a number of benefits that the interlocking directorates can bring to the enterprise (Siudak, 2018).

The enterprise at a given moment in time may be in one of three states of networking: 1) isolation, i.e. no demonstrated connections in the network (degree = 0), where the degree is the number of ties; 2) networking beyond the largest component (degree > 0 but no connection to the largest component); 3) networking within the largest component.

The aim of the article is to estimate the probability of changes between 3 specified networking states. The achievement of such a goal can contribute to the development of the theory of forming and functioning strategies based on the participation of organizations in the network. In particular, an attempt was made to answer two research questions. Firstly, is the process of the transition of enterprises between listed board interlocks stable or variable? Secondly, to which interlocking state is the organization most likely to migrate in the board interlocks network forming process? These questions identify a research gap in the literature on interlocking directorates. The aim of this paper was to fill this gap. This research is the first to show the measurement of the probabilities of the transitions between the interlocking directorates' states.

Two research methods were used in this paper. Social network analysis was employed to classify enterprises into one of the three states of networking. TheMarkov chain was used to estimate the probability of organizational transitions between the states of networking. The combination of both quantitative methods is an innovative approach in the research process.

We find that the interlocking network at the level of individual enterprises is characterized by relative variability in terms of the achieved networking state. In addition, regardless of the initial state, the company is most likely to be in a networked state within the largest component of the interlocking network, and least likely in the state of networking outside the largest component.

The paper is organized as follows. Part 2 presents the literature review. Part 3 presents the applied research method. Part 4 describes the data underlying the study. Part 5 is devoted to the results of the study, and the work is closed with final conclusions.

2. Literature review

The theory of resource dependency (Pfeffer, and Salancik, 2003/1978) assumes that the benefits of maintaining relationships with enterprises (through joint members of the board of directors) result from the coordination of inter-organizational exchange of resources, such as capital, information, legitimization, skills and market access. The need for companies to establish relationships with other organizations arises from the desire to have access to resources controlled by those organizations (Mintz, and Schwartz, 1985). Interlocking directorates is a tool for reducing uncertainty resulting from resource dependency and information asymmetry as a consequence of obtaining low cost benefits from access to information and coordination of activities. The aim is to obtain a number of benefits for the organization in the form of increasing market information, controlling the environment, reducing dependencies, reducing transaction costs related to the relationship between the company and external entities, as an instrument to protect against the negative effects of uncertainty arising from the external environment of enterprise (Pennings, 1980; Burt, 1983; Williamson, 1984; Pearce II, and Zahra, 1992; Pfeffer, and Salancik, 2003/1978).

The demand for resources controlled by external organizations creates a dependency between the enterprise and organizations in its environment. The number of relations with external entities determines the level of resource dependency of the enterprise (Boyd, 1990, p. 419). Managing the dependency of an organization consists in acquiring and controlling key resources necessary in the activity of the organization taken to reduce dependency on other organizations and increase dependency on other undertakings (Barringer, and Harrison, 2000, p. 372). At the same time, dependence on resources may also lead to negative aspects of the organization's participation in the network in the perspective of the problem of strategic dependence on the network (Lichtarski, et al., 2017). In this context, the dependence of enterprises on resources controlled by external organizations in the enterprise environment results in a complex structure of inter-organizational relations (Kaczmarek, et al., 2014, p. 350). Empirical confirmation of the theory of resource dependence is presented in the works of: Allen (1974); Pennings (1980); Provan (1980); Boyd (1990); Dalton, et al., (1999); Chin-Huat, et al., (2003), and Sankowska and Siudak (2015).

Creating a corporate linking structure through the board of directors enables the low cost of developing a reliable information flow channel, which is an important element in the adaptation of the strategy and the process of diffusion of practices between enterprises (Mizruchi, 1992; Galaskiewicz, and Wasserman, 1989; Hallock, 1997; Wong, et al., 2015; Davis, 1991; Davis, and Greve, 1997; Chuluun, et al., 2017; Mazzola, et al., 2016; Srinivasan, et al., 2018; Rao, and Sivakumar, 1999; Chen, et al., 2009; Ortiz-de-Mandojana, et al., 2012; Yang, and Cai, 2011; Connelly, et al., 2011; Shipilov, et al., 2010; Sharopshire, 2010; Perry, and Peyer, 2005). The benefits of interlocking networking of the corporation also concern the increase in the reputation of the board of directors (Schoorman, et al., 1981), reduction of information asymmetry (Lacker, et al., 2011), transfer of tacit knowledge between enterprises (Burt, 1980; Boyd, 1990; O'Hagan, and Green 2002, 2004; Uddin, 2012; Simoni, and Caiazza, 2013), and providing access to a source of critical resources for the organization (Mizruchi, and Stearns, 1988), including the possibility of raising debt capital (Mizruchi, and Stearns, 1994). Enterprises, depending on the sources of uncertainty, may look for different benefits of interlocking. In general, the flow of information that reduces its asymmetry and the absorption and protection of external resources reducing the inter-organizational resource dependency and the associated uncertainty are recognized as the main benefits of networking companies through the members of the board of directors.

There are also disadvantages associated with networking through interlocking. Interlocking with the use of a board of directors who sit on too many other boards may lead to an excess of their duties, which is referred to as "business directors" (Harris, and Shimizu, 2004). Then, limited time possibilities result in a decrease in the efficiency of the executive monitoring function in affiliated business boards (Core, et al., 1999; Shivdasani, and Yermack 1999; Fich, and Shivdasani, 2006). The costs of networking include the loss of partial autonomy and control over the company and flexibility in making decisions (Schoorman, et al., 1981), the possibility of a conflict of interests between related companies that compete with each other for the same resources, talents of social capital, co-operators or clients (Loderer, and Peyer, 2002), diffusion of harmful management practices, costs related to remuneration and costs of the representational fund of an additionally employed board member only due to the desire of interlocking with companies on whose boards the affiliate person sits. The decision to use the strategy of interlocking should be based on the relation of the possible benefits to the costs of interlocking, where their difference is determined by the economic result from interlocking, which can be both positive and negative. Participation in the largest component of the network enables the achievement of the indicated benefits from interlocking in a much wider scope. This particularly concerns the reduction of uncertainty in the company's environment through access to more and diverse resources, and participation in the flow of information in a wider scope. The use of the interlocking strategy with the lack of connection with the largest component may be associated with the reduction of benefits while incurring similar networking costs when combined with the largest component. Then a situation may arise where the costs of networking outweigh the benefits of interlocking. As a result, this leads to a decrease in the economic efficiency of networking. In particular, in order to create the enterprise value, the effect of acquiring resources and information from the interlocking network must be sufficiently strong, which may ensure participation in the largest component as a network of considerable size and potential benefits obtained (Siudak, 2018).

Participation in the board interlock network may have a positive impact on the financial results of the company. A positive influence of established relations in the interlock network on the return on assets (ROA) (Pombo, and Gutiérez, 2011; Lacker, et al., 2013; Horton, et al., 2012), return on equity (ROE) (Phan, et al., 2003; Pombo, and Gutiérez, 2011; Drago, et al., 2015; George, et al., 2001) and on profit has been demonstrated (O'Hagan, and Rice, 2015; Keister, 1998). At the same time, the positive impact of board interlocks on the value of the company has also been reported (Ferris, et al., 2003; Durbach, et al., 2013; Yeo, et al., 2003; Hallock, 1997). However, the effect of the created relationships in the interlocking directorates network on the value of the enterprise ignores the aspect of whether the enterprise is part of the largest component of the network or whether these relationships do not provide a link with the largest component of the network. This effect has been taken into account in the works (Siudak, 2017, 2018). Based on the analysis of variance (ANOVA), enterprises belonging to the largest network component have a significantly higher statistical market value than organizations that are outside the largest network component, but are not isolated in the network (Siudak, 2017). At the same time, it was shown on the basis of regression analysis that networking within the largest network component results in a higher market value of the enterprise (Siudak, 2018). In other words, in order to achieve a surplus of benefits over the costs of networking an undertaking, it is necessary to participate in the network within its largest component. Connection to the largest network component enables a wider range of participation in the flow of information, the possibility of acquiring resources from the organization's environment, and thus the effective reduction of uncertainty. Then, the benefits of established connections in the board interlock network will exceed the costs. Otherwise, if the company has relations in the network but is not part of its largest component, it means narrowed participation in the board interlock network and limits the possibilities of reducing uncertainty, and thus increasing the value of the company. The important issue is where the organization is in the state of networking; isolation; networking beyond the largest component; or networking within the largest component. In this context, the research questions posed in the introduction take on a significant dimension.

3. Method

The study of the interlocking directorates network can be implemented using a social network analysis. Whenever two companies share a director in the affiliation network (two-mode network), there is a link between them in the one-mode network. The board interlocking network derived from the two-mode network can be analyzed with the standard techniques of a social network analysis. The degree of a vertex is equal to the number of edges connected to it if the network is undirected, unweighted and without self-loops. Freeman (1979) indicate that degree is simple and measured by the number of direct ties involving a node in a network. In undirected and social networks there is a large component that contains more than a half of the network. The rest of network is divided into a large number of small components and isolated nodes. A component is a subset of the nodes of a network such that there exists at least one path between each vertex of that subset (Newman, 2010). Based on information about the degree and composition of the largest component, we can assign each firm to one of three states: 1) isolation; 2) outside the largest component; 3) inside the largest component.

In order to carry out the research, Markov chains were used, which are defined as processes with discrete time space. Initially, the application of Markov processes took place in physical sciences, and over time useful applications were found for economic sciences. The basic properties of Markov's processes are (Lawrence, and Pasternack, 2002, pp. CD-73):

1) The process under consideration consists of a countable number of stages.
2) At each stage the process may be in a countable number of possible states.
3) The probability of the process passing from state i in step t to state j in stage $t + 1$ is independent of the way in which the process was in state i.

Consideration will be given to the process for which we accept the process of the networking of enterprises, where, in accordance with the adopted model, may in moments $t = 0, 1, 2, \dots, N$, occur in one of three states $S = \{1, 2, s = 3\}$. The course of the process is stochastic (X_t, $t \in N$) and is a Markov process if variables X_t are dependent, i.e. they meet the Markov condition if the following equation is fulfilled

$$P(X_t = j | X_0 = i_0, X_1 = i_1, \dots, X_{t-1} = i) = P(X_t = j | X_{t-1} = i) \text{ for } i, j \in S,\ t \in N \tag{1}$$

For particular moments $t \in N$ and for particular states $i,j \in S$, probability that the process will be in state j at moment t, provided that in moment t-1 the process was in state i, it is independent of the states in which the process was in the moments preceding moment t-1. This means that the future state of the process is independent of the state in the past. Markov processes are characterized by the lack of process memory property. Thus, the influence of the past on the future evolution of the process depends only on the observed state of the process at the last moment. The way a process is found in a certain state does not affect its future evolution (Iosifescu, et al., 2010). The estimation of the matrix of probabilities of Markov chain passages was carried out on the basis of macrodata, which is the most common in practice.

It is important to signal the originality of the research approach through the use of both research methods in one study.

4. Data

We analyzed the composition of corporate board and director networks in Poland between the end of 2015 and the end of 2016. We obtained corporate board information on the 845 companies listed in the main market at the Warsaw Stock Exchange and in the NewConnect market in the above period. These data were obtained from the Notoria database and checked for consistency. The corporate board network was constructed with 845 boards as vertices connected by an edge if they shared at least one director. The networks are undirected and unweighted.

On the basis of 845 stock exchange enterprises listed continuously during the period from the end of December 2015 to the end of December 2016, 5 networks were constructed at quarterly intervals, i.e. at the end of periods (t): 1) 12-2015; 2) 03-2016; 3) 06-2016; 4) 09-2016; 5) 12-2016. On that basis, conversions of enterprises' transitions between the specified three network states were made. The number of enterprises in individual network states is presented in Table 1. These data were obtained using NetMiner 4.4.3 Cyram (2019).

Table 1.
Number of companies in the specified networking states

Period	Isolation	Outside the largest component	Inside the largest component	Total
12-2015	247	110	488	845
03-2016	250	93	502	845
06-2015	254	106	485	845
09-2016	252	133	460	845
12-2016	257	106	482	845

Source: author’s own elaboration.

It is enough to establish only one connection for the company's networking (degree = 1). The formal condition for entry into the largest component is establishing at least one relationship with the company connected to this component. Other companies included in the largest component of the network have connections in more than 1. On the basis of the mean degree for the entire network – amounting to 2.67, and 4.28 for the largest component – the assumption can be made that the entry into the largest component is provided by the first two or three connections. For companies outside the largest component and those isolated, the average degree was 0.51. If isolated companies that do not use the interlocking strategy (degree = 0) are excluded from the group of enterprises not connected to the largest component, then the mean degree is 1.69. On the other hand, only an average of 78 companies were connected to the largest component by concluding only one relationship.

5. Results

Changes in the state of the analyzed process of enterprise networking in subsequent stages t∈N are shown in table 2.

Table 2.
Number of company transitions between specified networking states

	Networking states	03-2016 Isolation	03-2016 Outside the largest component	03-2016 Inside the largest component	Total
12-2015	Isolation	232	6	9	247
12-2015	Outside the largest component	5	82	23	110
12-2015	Inside the largest component	13	5	470	488
	Total	250	93	502	845
		06-2016			
	Networking states	**Isolation**	**Outside the largest component**	**Inside the largest component**	**Total**
03-2016	Isolation	225	3	22	250
03-2016	Outside the largest component	8	78	7	93
03-2016	Inside the largest component	21	25	456	502
	Total	254	106	485	845
		09-2016			
	Networking states	**Isolation**	**Outside the largest component**	**Inside the largest component**	**Total**
06-2016	Isolation	231	10	13	254
06-2016	Outside the largest component	5	91	10	106
06-2016	Inside the largest component	16	32	437	485
	Total	252	133	460	845
		12-2016			
	Networking states	**Isolation**	**Outside the largest component**	**Inside the largest component**	**Total**
09-2016	Isolation	230	7	16	253
09-2016	Outside the largest component	5	90	38	133
09-2016	Inside the largest component	22	9	428	459
	Total	257	106	482	845

Source: author's own elaboration.

The sum of elements of individual lines means the number of enterprises in the respective process states at the beginning of a given period, and at the same time at the end of the previous period, while the sum of elements of individual columns indicates the number of companies in individual groups at the end of the analyzed period. The probabilities of transitions between individual networking states, being elements of the probability matrix (**P**) of chain transitions, are presented in Table 3.

Table 3.
Probabilities of company transitions between networking states

Networking states	Isolation	Outside the largest component	Inside the largest component	Total
Isolation	0.000	0.478	0.522	1
Outside the largest component	0.706	0.000	0.294	1
Inside the largest component	0.393	0.000	0.607	1

Source: own elaboration.

The estimated probabilities of transitions concern only the first period, and the question of determining probabilities of transitions in subsequent steps (periods) will be the subject of consideration later. Table 4 presents the mean probabilities of changes in the state of networking in the next 6 quarter periods.

Table 4.
Mean probabilities of transition between networking states for the next 6 stages

Period	Isolation	Outside the largest component	Inside the largest component
t = 1	0.366	0.159	0.474
t = 2	0.299	0.175	0.526
t = 3	0.331	0.143	0.527
t = 4	0.308	0.158	0.534
t = 5	0.322	0.147	0.531
t = 6	0.313	0.153	0.533

Source: author's own elaboration.

For each subsequent period ahead from 2016, when the latest empirical data were collected, the mean probability of an enterprise getting into one of the three networking states after a certain number of steps was estimated. For example, after 6 steps, the probability of getting into the largest component was 53.3%, and in the state of isolation it was 31.3%, regardless of the state the network was initially. For all 6 stages, the probability of getting into the largest component is greater than the likelihood of isolation. The figures below show graphically the changes in the probabilities of the process transition according to the state of isolation (Figure 1); networking outside the largest component (Figure 2); networking inside the largest component (Figure 3).

The likelihood of reaching the state of the enterprise networking state in the largest component is increased in relation to the passing of time, especially in the period of one year (Figure 5). The reason for this may lie in the possibility of achieving surplus benefits over the costs of networking as a result of the relational strategy.

Isolation of the enterprise from the interlocking directorates results in the lack of receiving the expected benefits from networking, and the costs of networking are not incurred. The economic result of interlocking, which is defined as the difference between the benefits and the costs of networking, is 0. On the other hand, reaching the state of networking outside the largest component can lead to excess costs over benefits from networking. This may explain the reason for the decrease in the probability of reaching the state of isolation and networking beyond the largest component over a period of 7-8 quarters.

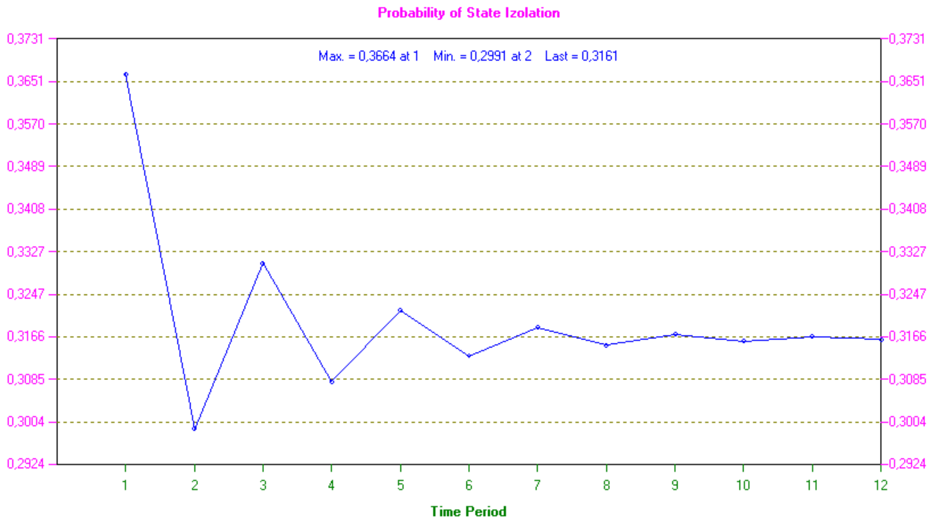

Figure 1. The probability of the chain passing to the state of isolation in relation to time. Source: author's own elaboration.

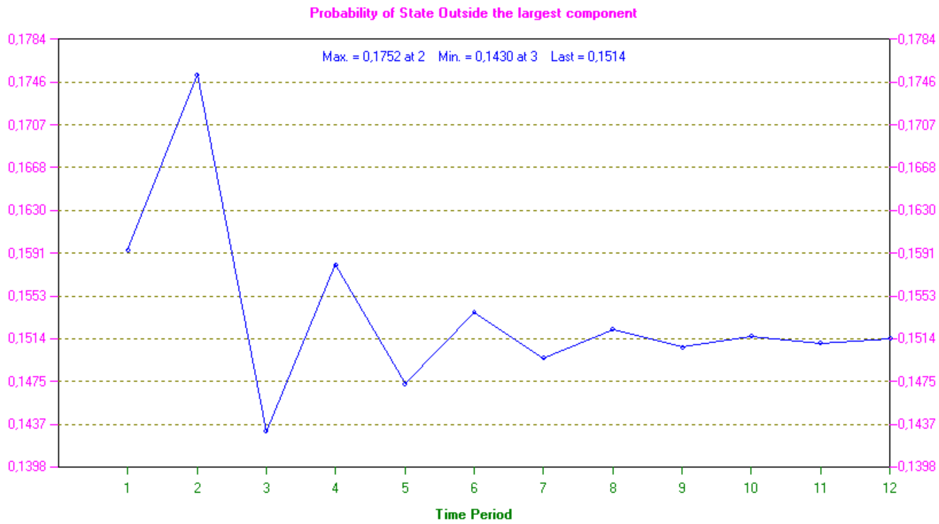

Figure 2. Probability of the chain passing to the state beyond the largest component in relation to time. Source: author's own elaboration.

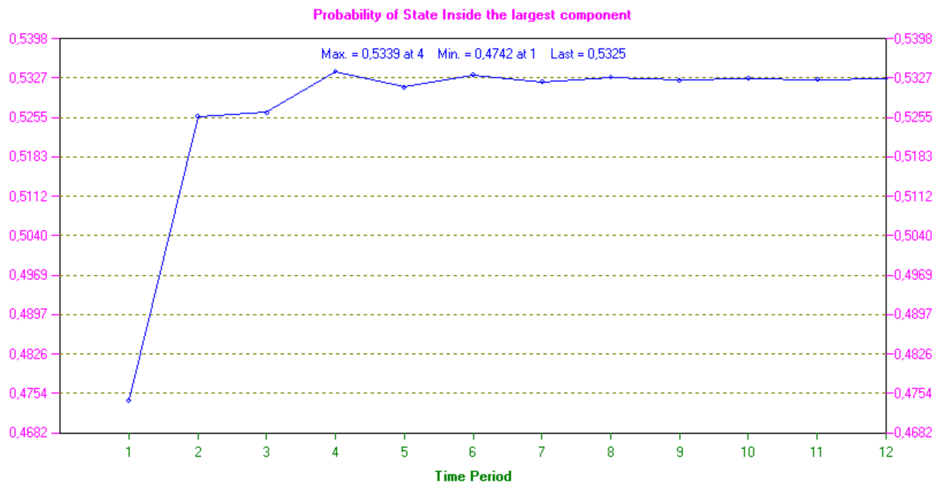

Figure 3. Probability of the chain passing to the state of the largest component in relation to time. Source: author's own elaboration.

Because the determined probability matrix of **P** transitions (see Table 2) of a finite homogeneous Markov chain is non-degradable and non-cyclical, the **P** matrix is a regular matrix and the chain is ergodic. For the appropriate number of steps (t), which is a suitable passage of time, the probability of the process reaching individual states is equal to the corresponding elements of the stationary boundary vector **e**, independent of the initial state of the process

$$\mathbf{e} = [0.316\ 0.151\ 0.533]$$

Since the boundary vector $\mathbf{e} > 0$, the matrix of probabilities **P** is non-reducible, and in consequence, after a sufficiently long elapse of time each enterprise may be in one of the three networking statuses.

Because the chain in question is ergodic, the probability of passing the process to individual networking states is independent of the initial state. The ergodic limit matrix has the form of

$$\lim_{t\to\infty} P^t = \boldsymbol{E} = \begin{bmatrix} 0.3160.1510.533 \\ 0.3160.1510.533 \\ 0.3160.1510.533 \end{bmatrix}$$

Irrespective of the initial state of networking in which an enterprise is currently located, the probability of long-term isolation in the networking is less than 31.6%; inside the largest component, 53.3%, while in the state outside the largest component – 15.1%. At the same time, it indicates that considering the large set of enterprises in the longer term, it can be stated that in the above proportions the company spends time in individual networking (32% of the time in isolation, 53% in the largest component and 15% outside the largest component). The level of constant probability of transition to states 1) isolation; 2) network connections outside the largest component and 3) within the largest component is achieved in quarter, respectively: 9, 10, 6 (from 1.5 to 2.5 years).

For the ergodic and non-reducible Markov chain, we can determine the expected time of the chain return from the state exit i to its first return to state i. This time determines the expected number of steps. If at a certain point the Markov chain stays in state i, then at the next moment of time (here the time is discreet) it can either remain in state i, which means that the process has returned to this state in one step, or go to another state. Since the ergodic matrix of transitions is regular and all states belong to the class of significant communicating states (no zeros for elements e_i of the border vector e), there is a finite time (number of steps) after which the chain will return to the initial state, i. Table 5 shows the expected return time chain for individual networking.

Table 5.
Expected time of return of the Markov chain to individual enterprise networking statuses

Networking states	Expected time of return [quarter]
Isolation	3.16
Outside the largest component	6.61
Inside the largest component	1.88

Source: author’s own elaboration.

The expected times of returning of a process to a specific networking state concern the period that elapses from the exit of an enterprise from a given state until it returns to the same state. The expected time of returning the company to the state of networking in the largest component is 1.88 quarters (approximately 24.5 weeks). If the company loses the link guaranteeing connection with the largest component, the expected return to the largest component is less than 25 weeks. However, the return to the state of networking outside the largest component is 6.6 quarters. In other words, the state of networking beyond the largest component is a kind of transitional state. If the company makes a link allowing for connection with the largest component or goes into a state of isolation, it will take over 1.5 years to return to the networking beyond the component. On the other hand, the expected time of returning of the process to the isolation condition occurs after 3.2 quarters. This may prove relatively difficult to maintain in the long-term connection in the interlocking network.

6. Conclusions

In this study we estimate the probability of changes between 3 specified networking states. The probability of passing the process to specified networking states is independent of the initial state. With regard to the first research question, it should be stated that the interlocking network at the level of individual enterprises is characterized by relative volatility in terms of the achieved state of networking. Isolation of the enterprise is to some extent the result of the enterprise's decision. However, a networked company may lose its connection with the largest component as a result of breaking the direct link (it concerns the so-called pendant nodes) or following the break of the indirect connection. In the first case, as a result, the company most often changes the state of networking connection from the connection to the largest component of the network to the state of isolation. In the second case, the company remains networked but located outside the largest component. The mechanism of changing the networking process works similarly in the opposite direction. On the other hand, the change in the state of networking between isolation and networking beyond the largest component results from a change in purely direct relationships. The protection against changing the state of networking with the connection to the largest component of the network to the other two is the pursuit of an appropriate networking strategy consisting in maintaining one relationship with a strongly networked company, the so-called hub, or maintaining more connections with the less centrally compliant companies included in the largest network component. Then, the loss of one link does not change the state of networking. The structure of the network in terms of the number of companies in isolation and networking in the largest network component is relatively stable, especially for two opposing states – isolation and networking within the largest component. However, at the level of individual network actors, the dynamics of the networking process in time is relatively high. In the long-term, each company, irrespective of the current state of the process, may be in one of the three networking states.

In relation to the second research question, the research conducted allows us to conclude that the organization has the highest probability of transition to a state of networking within the largest component of the network. The growing probability of being in a networked state within the largest network component (see Figure 3), the highest constant probability of being in this state regardless of the initial state and the shortest time of chain return to this state (see Table 4) shows the possibility of achieving a surplus of benefits over the costs of networking and, consequently, obtaining economic benefits from the use of a networking strategy.

This study contributes to the social network literature. The high constant probability of transition to the state of networking in the structure of the largest network component indicates the importance of conducting the organization's relational strategy. The organization's relational strategy displaces the atomic form of perception of the enterprise's activity. Participation in the board interlock network may be associated with receiving benefits in excess of the costs of maintaining relations in the network. As a result, an enterprise, by participating in the network exchange of information and potential exchange of resources with other organizations, may improve financial results and increase market value. On the other hand, competition in the demand for external resources may lead to changes in the state of the company's networking in the interlocking network.

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