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Property rights and the formation of interfirm networks: a network analysis of the interlocking directorates in China's listed companies

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Abstract

Interfirm networks are one of the core modes of corporate governance. However, its formation mechanism is not clearly and adequately delineated. This article highlights the significance of property rights to the formation mechanism of interfirm networks. Using interlocking directorate data from Chinese listed companies during the years 2000–2010, we investigate the association between ownership and network formation, at both the individual attribute level and dyadic level. Results show that companies owned or controlled by the state are more likely to form interlocking networks, and these relations tend to emerge among companies that have identical ownership. The higher the administrative level to which state-controlled companies are affiliated, the more likely they are to form interlocking networks. Theories of economic efficiency also have some explanatory power regarding network formation.

Keywords: Interfirm networks, Interlocking directorate networks, State-owned property rights, Supervision modes of state-owned assets

Introduction

While neoclassical economists highly praise hierarchy or market company governance modes, sociologists maintain that economic actions are embedded in a particular social structure. Structured social network relations are the foundation of any economic action; therefore, effective modes of company governance must take into account the social network relations between economic agents (Williamson 1975; Granovetter 1985). Specifically, the interfirm network is one of the most important social network relations.

Putting forward the idea of interfirm network relations has changed the traditional way of studying enterprises. Unlike the corporate governance modes of hierarchies or market, the operation of any interfirm network does not rely on prices or the mandates of formal authorities; instead, it derives from mutual trust, common interests, and shared reputation that have been created through interactions between enterprises over a long period of time (Podolny and Page 1998; Li 2010; Lin 2002). Since the 1980s, studies on interfirm networks have become the order of the day in Western academia,

with topics encompassing interlocking directorate networks, joint venture or cooperation networks, industry constellations, strategic alliances, business groups, subcontracting and outsourcing agreement networks, membership of chamber of commerce networks, and so on (Oliver 1990; Galsberg and Schwartz 1983). A consistent discovery is that interfirm networks could reduce transaction cost, transmit signals of legitimacy to the outside world, and improve corporate performance (Keister 1998; Podolny 2001; Bian and Qiu 2000; Li and Dong 2003).

Although management studies, organization studies, and sociology have had thorough discussions on the influence and outcomes of interfirm networks, exploration of their formation mechanisms remains incomprehensive. We do not have a clear idea about the key elements for constructing interfirm networks, nor do theories imported from Europe and America sufficiently explicate the patterns of Chinese interfirm networks. One important reason for this is that past studies on the construction of interfirm networks are often predicated on a given market's economic efficiency, thus ignoring the institutional backgrounds of network production. Since many sociologists emphasize that economic acts are embedded in social network structures, interfirm networks are also embedded in specific political and economic structures; in this case, they cannot be reduced to a universal network pattern. For example, interfirm networks in East Asia exhibit a different formation mode than those in Europe and America. State and kinship relations have played a crucial role in the construction of East Asia's interfirm networks (Scott 1991). Studies on Chinese enterprises' governance practices also show that there is no best enterprise governance structure per se; good enterprise governance structure is a product of specific social, political, economic, and cultural environments (Yang 2013).

This article uses the interlocking directorate networks of Chinese listed companies as an exemplar to investigate the dual logic, i.e., economic and institutional, behind the construction of China's interfirm networks. This can make up for the shortcomings of past studies that had a heavy focus on economic efficiency but not enough attention on institutional background. Generally speaking, the construction of interlocking directorate network requires directors, supervisors, or senior managers to serve on no less than two companies. This kind of network is sometimes also ingeniously portrayed as "straddled directors/supervisors" (Li 2007, 2009).

In various fields of social sciences, studying interlocking directorate networks can contribute to the understanding of company governance, company performance, class cohesion, unified action of business elites, and so on (Ma 2014). China's management studies have provided a foundation for studying Chinese interlocking directorate networks (Ren et al. 2001; Ren et al. 2004, 2007; Lu and Cheng 2009; Han et al. 2015). Because data of listed companies are rich, authoritarian, and attainable, American economic and organizational sociologists have always stressed the importance of collecting and using these materials. Chinese economic and organizational sociologists should also fully exploit this resource, expanding the span of relevant studies focusing on socioeconomic changes during China's economic transition. This article can be viewed as a preliminary attempt at achieving this goal.

Literature review

At the firm level, past studies on the construction of interlocking directorate networks have mainly adopted the perspectives of economic and management efficiency. The

first approach is resource dependence theory, which was first put forward through Pfeffer and Salancik's (1978) study on organizational behavior. Before that, the focal point of organization studies was how the governance structure of an organization can influence the organization's behavior. Resource dependence theory shifted the focus of study from economic efficiency to the organizational environment, arguing that the external environment of an organization is an important force in the existence and development of the organization. To reduce an organization's dependence on external resources and the risks it faces, an organization would interact with its external environment, e.g., absorbing threatening elements (Selznick 1949). The control relationship resulting from the dependence on external resources is the main reason for the construction of inter-organizational relations.

Based on this theory, one important goal for constructing interlocking directorate networks is to reduce enterprises' dependence on external resources, thus reducing the uncertainties that may be caused by resources' volatility. Board directors not only supervise managers within an enterprise but at the same time also play the role of a resource provider (e.g., consultant) and/or a matchmaking informer for the enterprise's development. The social capital (i.e., relationships) of any interlocking directorate is precisely manifested through its ability to provide useful information for the enterprises; it is an effective means for enterprises to acquire the key development resources (Hillman and Dalziel 2003). Empirical research has shown that building an interlocking directorate network with investment banks can reduce enterprises' dependence on investment banks (Baker 1990).

The second approach is supervision and control theory. Unlike resource dependence theory that focuses on organizations that demand external resources, supervision and control theory looks at organizations that offer resources. This theory maintains that resource suppliers not only control resource consumers but also supervise the way resources are consumed to guarantee suppliers' benefits and interests. The resource suppliers of many companies, such as stockholders, creditors, and manufacturers, appoint directors to supervise the operation of such companies to achieve control.

Empirical studies have shown that the separation in companies between ownership and management is only a formality; in terms of interfirm networks, the two are usually closely intertwined (Roy and Bonacich 1988; Windolf and Beyer 1996; Bohman 2012). For example, studies on the economic structure of large Japanese business groups (Lincoln et al. 1992) show that cross-shareholding and interlocking directorate networks are the two very common control methods of business groups. By controlling the shareholding and human resource division of an enterprise, business groups are not only able to achieve mutual benefits through commodity and finance transactions but also at the same time guarantee that the business groups upholding the core positions in the market can acquire more economic benefits.

The third approach is financial control theory. Because of the important role of currency in capitalist production and reproduction, financial control theory emphasizes the core position of financial institutions in interlocking directorate networks. Studies of American enterprises' interlocking directorate networks in the 1960s discovered that those occupying the core positions of most interlocking directorate networks were banks and insurance companies (Mizruchi 2007; Mintz and Schwartz 1981). Studies of Canadian enterprises' interlocking directorate networks in the 1960s also show that

financial institutions would be based on the situations of running their invested enterprises to selectively appoint directors to supervise them and urging nonfinancial enterprises to make conservative investments (Richardson 1987).

Some scholars have noted that the power structure of enterprises changes along with a change in economic structure (Mizruchi 2004). Since the 1990s, due to the diversification of financial services and development in technology, American banks have transitioned from doing traditional financing businesses to doing financial services; as a result, the importance of banks in interlocking directorate networks has dropped consistently, and they no longer hold any core positions.

The fourth approach is collusion theory. This theory argues that the emergence of interlocking directorate networks is due to the collusion among enterprises (Mizruchi 1996). To reduce competition, especially between businesses of counterparts in the same industry, enterprises appoint directors for each other. Through interlocking directorate networks enterprises that were initially competing with each other could now have coordinated actions and thus acquire high profits.

Last is geospace mechanism or propinquity theory. When placed near each other, enterprises are more likely to have frequent interactions. One important premise for building interlocking directorate networks is that enterprises must be aware of each other's existence. The analysis of Kono et al. (1998) about Fortune 500 companies shows that the distance between the headquarters of enterprises can influence the construction of interlocking directorate networks between them.

Theory and hypotheses

The above theories have explained the basic formation mechanisms of interlocking directorate networks among enterprises within a market economy, which can be called the "market theory" for the construction of interlocking directorate networks. However, previous studies have more or less neglected the political and economic backgrounds within which interlocking directorate networks are constructed. A consensus among economic sociologists is this: sociological studies of company governance should pay attention to institutional origins, action processes, and influences on social agents, and how they evolve over time (Davis 2005; Yang 2012). With regard to the institutional environment of Chinese enterprises, what is different in China's market economy is how state forces can have direct control over or indirect influence on Chinese enterprises (Zhang 2010; Keister 1998; Walder 2011). Through what mechanism can state-owned enterprises (hereafter SOEs) construct their interlocking directorate networks? Moreover, is there any discrepancy between these networks and the economic logic of market theory? Apart from economic reasons, do state-controlled enterprises abide by political orders, policy necessities, and social demands? Without empirical evidence, there are no answers to the above questions as of now. Starting with market theory, this article aims to expound on the institutional foundation of interlocking directorate networks of Chinese enterprises, especially SOEs, from the perspective of the unique governance structure of SOEs[1] and the special supervision mode of state-owned assets.

State-owned property rights and the politicized structure of company governance

1. Ownership by state

The most common definition for property rights consists of the right to own, possess, use, profit from, control, dispose of, and transfer goods and commodities (Kang and Sørensen 1999; Zhou 2005). Within this bundle of rights, the most important is the right to possess and control goods and commodities.

State-owned property rights, called state ownership for short, are a special kind. It is the result of state input or investment in SOEs. Compared to private, public, and communal ownership, the particularity of state ownership rests on the status of the state as an entity and that it has multiple goals. The state not only provides an institutional guarantee for the implementation of its ownership, but also benefits from this ownership. Investment by the state or input in state-owned assets are not only made to gain a huge economic return but also to satisfy the needs of social welfare. In addition, they are made to secure the state's role in guiding the national economy or implementing new industrial policies (Carruthers and Ariovich 2004).

Besides a small number of state-owned unincorporated economic organizations and solely SOEs, those who best manifest the differences between state ownership and non-state ownership are the public listed companies in China. There are three types of listed companies owned by the state: those with the state as the absolute stockholder, those with the state as a relative stockholder, and those with the state as a shareholding entity. The state not only influences listed companies as the largest shareholder or as one of the major shareholders but also indirectly influences listed companies through multiple control chains as an ultimate controller.[2]

2. Politicized corporate governance

The corporate governance structure is the institutional framework for normalizing the rights and duties of shareholders, directorates, senior managers, and other stakeholders. A good governance structure can improve corporate competitiveness. The governance structure of Chinese enterprises rests on the separation between decision-making power, supervisory power, and executive power. China's Company Law states that the general meeting of shareholders is an enterprise's center of power and that any shareholder attending a board meeting obeys the rule of "one share, one vote." Directors and supervisors are elected by the general meeting of shareholders. A board of directors usually consists of 5–19 people; each board of director's term of office cannot exceed 3 years, though reappointment is allowed. The board of directors is the core governance structure of an enterprise, holding the rights to an enterprise's finance allocation, strategic decision making, and the appointments of senior managers. The board of supervisors has the power and function to supervise the board of directors and managers. The general manager is recruited or dismissed by the board of directors and remains accountable to the board. The general manager is mainly responsible for running and managing an enterprise's concrete production and for putting forward to the board issues related to the hiring or dismissal of other senior managers.

China's Company Law also states that an enterprise must set up a department for the Chinese Communist Party (i.e., the Communist Party Committee) and provide the necessary condition for the organizational activities of the party. In non-public-owned enterprises, the Communist Party Committee does not intervene in the running and production of the enterprise. Especially in non-state-owned listed corporations, the

Communist Party Committee would not intervene in any corporation's board of directors, supervisors, or managers, nor would the committee place any restriction on the general meeting of shareholders when making decisions. The Communist Party Committee's purpose is to help guide and broadcast political ideologies in Chinese enterprise.[3]

However, the Communist Party Committee has an important role in the governance structure of for state-owned corporations. It is the political core of SOEs, responsible for securing the execution and implementation of China's major policies in these enterprises. In this case, the work of any board of shareholders, directors, or supervisors can become actualized by first gaining support from the Communist Party Committee. More importantly, with regard to all the major issues related to SOEs, the decision-making process must necessarily involve the Communist Party Committee.

We name the above governance structure of China's state-owned corporations a "politicized governance structure." There are two aspects to this structure. First, the recruitment of corporate leaders (e.g., directors and general managers) is integrated into hierarchical levels of governmental personnel, and different corporate leaders usually have different administrative ranks like those of Communist Party officials (Walder 2011; Sun 2012). Second, through the creation of The Communist Party Committee, the state can intervene in the internal governance of state-owned corporations (Nee and Opper 2007).

3. The construction of interlocking directorate networks

Within the politicized governance structure, there are two measures of personnel appointment that have increased the possibility of constructing interlocking directorate networks among SOEs. One is the outside director system, and the other is the leadership rotation system. Non-SOEs do not have these restrictions.

Outside directors refer to directors appointed from enterprises other than their own. This is one of the main reasons for SOEs to build interlocking directorate networks. Outside directors are usually people with special talents, including eminent experts, scholars, and entrepreneurs who are rare and needed. This has objectively created a situation where one director simultaneously works for several SOEs.

The leadership rotation system is limited to the alternation and rotation of roles[4] between leaders in SOEs. Building a system whereby important and sensitive posts taken by enterprise leaders and cadres are regularly rotated not only train cadres and increases their abilities but can also prevent the power of enterprise cadres from being centralized and thus breeding corruption, i.e., private possession of state-owned assets. The rotation and alternation of enterprise leaders and cadres also promotes the growth of interfirm networking. For example, say there are two state-owned listed corporations, A and B. A leader of corporation A is transferred to corporation B to take a leadership position but because he/she is familiar with the business of corporation A, the supervision and management division of state assets can still appoint him/her as a regular director for corporation A.

Based on the above two points, one can put forward the first hypothesis.

Hypothesis 1 State-owned or controlled corporations are more likely to form interlocking directorate networks than non-state-owned or controlled corporations.

Apart from that, from the perspective of organization studies, the behaviors of organizations under the same institutional pressure are likely to be homogenous (Zhou 2003). State-owned corporations not only have to face market pressure like other non-state-owned corporations but also have to accept the personnel allocation, supervision, and restrictions from the higher Communist Party commission, which gives us the second hypothesis.

Hypothesis 2 Enterprises with the same property rights are more likely to constitute interlocking directorate networks.

State-owned property rights and the supervising and administering pattern of state-owned assets

1. The historical evolution of the regulatory pattern of state assets

In 1997, the CPC's Fifteenth National Congress put forward the SOE reform idea of "focusing on the restructuring of major enterprises while leaving minor ones to fend for themselves." This required the government to change its function and further establish systems of clear rights and responsibilities for managing, supervising, and running state assets to guarantee their maintenance and appreciation. In 1999, the former State Economic and Trade Commission introduced policies relevant to the above change, clearly stating that state-owned corporations, after being restructured and listed as stock corporations, must usually adopt the three-tier authorization management model. The first tier is the government division that supervises and manages state assets; the second tier is the "authorized investment institutions" that run state assets but are administered by the state supervision division of state assets; the third is the shareholding corporations whose shares are dominated by the authorized investment institutions.

Among the above three tiers, state-owned listed stock corporations do not hold the position of an independent legal representative; their majority stocks are controlled by authorized investment institutions that are also the dominant shareholders of these corporations. The directorate or managers of these institutions often take positions such as a board director or chairperson of the board in listed corporations. Such dual identity can cause listed corporations to be controlled by insiders or lead to the loss of state assets.

To tackle this problem, the State-owned Asset Supervision and Administration Committee (SASAC) was established in March 2003, which clearly demonstrated the investor position and responsibilities of the central government and local governments. The SASAC of the state council is an administrative institution designed to deal with issues related to the ownership of nonfinancial SOEs. From 2004 to 2005, SASACs subject to governments of all levels (i.e., provincial, borough, and district) were also established.

The regulations announced by the state council in 2003 clarified the responsibilities for the three levels of the SASAC, including that of the state council; those of provinces, including municipalities; and cities. Here, the most important thing was that this clarification solved the problem in the original three-tier administration model, i.e., the lack of an owner. SASACs of all levels must represent the state, including its responsibility as the investor of state assets, its role to promote rational arrangement of the national economy, and to secure the maintenance and appreciation of state assets. The

executive functions originally performed by China's Planning Commission, State Economic and Trade Commission, the Organization Division of the Communist Party Committee, the Treasury Department, and so on have been unified into the three levels of the SASAC.

2. The construction of interlocking directorate networks

Based on the regulations applying to SASACs, the scope of SASAC's administrative power is defined by its level of governance; the higher the governance, the larger the power. First is the SASAC of the state council, which not only deals with affairs of SOEs concerning national economy and homeland security but also supervises and administers state-owned shareholding or state-controlled shareholding corporations that are crucial to the fields of infrastructure and resources. The provincial and municipal SASACs follow, which pick up the state-owned corporations that are "left" by the state-council SASAC to supervise, administer, and perform the investor's duties. We call this top-down administrative model of SASAC the "optimum seeking method."

Having clear administration goals can reduce the scale of administration. The upscale enterprises administered by the Chinese central government in 1992 numbered as many as 3825. The average number of upscale corporations administered by each provincial government was 326, and the average number of upscale corporations administered by each district government was 34 (Walder 1995). The whole administration structure was a reversed pyramid. According to the information published on the state council SASAC's Website, up until August 2015, the number of corporations administered by the state-council SASAC has been reduced to 112 and involved important fields of aerospace/spaceflight, the military industry, information technology, petroleum and petrochemical industries, electric power, and coal mining.

Establishing SASACs at different administrative levels has strengthened the top-down influence of state ownership on the construction of interlocking directorate networks. According to the regulations for administering and supervising state assets, the SASAC holds the ultimate power in appointing and dismissing leaders of state-owned corporations. The one important responsibility of each administrative-level SASAC is to appoint, dismiss, assess, and award or punish the principals of state-invested corporations based on their performance.[5] Especially, within the administration model of the optimum seeking method, the higher the executive power of a SASAC, the more difficult its administrative efforts. This is because this kind of SASAC often manages state-owned corporations that are vital to Chinese people's livelihood and the national economy. Accordingly, one could infer that the influence of state ownership on the construction of interlocking directorate networks can be differentiated based on the executive levels of SASACs. The stricter the corporations' personnel appointments (e.g., subject to external directors and the leadership rotation system), the more likely it is that state-owned corporations will construct interlocking directorate networks. Based on this assumption, I put forward two more hypotheses about the formation of Chinese interlocking directorate networks.

Hypothesis 3 State-owned or state-controlled corporations are more likely to have interlocking directorate networks; this is especially true after the establishment of SASACs.

Hypothesis 4 The higher the administrative level of an SASAC to which state-owned or state-controlled corporations are affiliated, the more likely it is that these corporations will form interlocking directorate networks.

Data and research design

Data

This article uses data on Chinese listed companies from CSMAR (China Stock Market Accounting Research) of Shenzhen GTA (*Guo Tai An*) Information and Technology Limited Corporation. This data source includes information on directors, ownership, geographical location, industry type, corporate size, firm age, balance sheets, and firm performance of all listed companies in China's A-share market.

Measurement

Based on the basic approach of social network analysis (Hanneman and Riddle 2005), this article adopts two levels of variables: the attribute level and the dyad level. The data on individual attributes are very common, whereas network dyads are the basic data type for social network analysis; it is a depiction of the relations or ties between any two nodes. Because this article mainly investigates whether there are interlocking directorate relations between any two listed companies (two nodes), it only utilizes the binary and nondirectional types of network relations data.

1. Attribute-level dependent variable

On whether interlocking relations exist or not, if two companies share at least one board director, it is denoted as 1, otherwise 0. Since the CSMAR dataset provides information on the names, age, and gender of all board directors, the criterion for identifying an interlocking network relations is if within the same year, two or more companies share board directors who have the same name, age, and gender. There is thus a strong possibility that those directors are the same person, and these companies have an interlocking tie. Mani and Moody's (2014) study on Indian interfirm network of shareholders only used names of shareholders to build networks among corporations and ignored screening information such as gender and age; as a result, they cannot prevent the occurrence of shareholders who have the same name but are not the same person. In comparison, this research is more trustworthy when it comes to the construction of interlocking networks.

2. Attribute level independent variables

This article uses two indexes to measure the ownership of a company. The first is whether the largest shareholder of a corporation is the state; the second is whether the ultimate controller of a corporation is the state. As the main investment body of SOEs becomes more and more multivariable, the state is likely to use the role of an ultimate controller instead of the largest shareholder, through major business groups, management companies of state assets, and state asset investment companies, to indirectly control China's listed companies. Moreover, using the ultimate controller as an index

also provides information about administrative levels of governments that control the listed companies. Through this index, we can reveal the discrepancies of interlocking networks of SOEs that are affiliated to different administrative levels (Keister and Lu 2004; Xia and Chen 2007; Yang et al. 2010).

Below is the operationalization of these variables.

Ownership

(1) Largest shareholder: state as the number one shareholder=1, otherwise 0; (2) state control: state as the ultimate controller=1, otherwise 0; (3) government control of different administrative levels: central government=1, provincial government=2, city government=3, county and township government=4, nongovernment control=5.

Region

Corporations' registered addresses; North China (Beijing, Tianjin, Hebei, Shanxi, and Inner Mongolia)=1, Northeast China (Liaoning, Jilin, and Heilongjiang)=2, East China (Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong)=3, Central South China (Henan, Hubei, Hunan, Guangdong, Guangxi, and Hainan)=4, Southwest China (Chongqing, Sichuan, Guizhou, Yunnan, and Tibet)=5, Northwest China (Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang)=6.

Industry

The industry type of a corporation's main business: real estate=1, manufacturing=2, public services=3, finance=4, commerce=5, and hybrid business=6.

Total assets

Measures the size of each company; the logarithm is already taken.

Age

The difference between the current year and the year an enterprise was established.

Debt-to-asset ratio

Debt-to-asset ratio is an index for measuring the debt level of an enterprise and the loan safety level of a creditor from whom the enterprise borrows.

Return on equity (ROE)

The ratio of net profits and net assets; it is an index for evaluating corporate performance and shareholder returns.

Table 1 presents the descriptive statistics of all attribute-level variables.

3. Dyad-level dependent variable

Dyad-level variables depict the relationships between paired nodes. We followed the operationalization of previous well-known studies (Burris 2005; Dreiling and Darves 2011). Every dyad-level variable can be constructed as a matrix composed of the elements 1 and 0. The rows and columns of these matrices represent companies, and every element in these matrices represents the network relation between two companies. The dyad-level dependent variable here is interlocking directorate networks. In the matrices, two companies having interlocking relations are denoted by 1, otherwise 0.

Ownership networks

(1) Largest shareholder networks: the largest shareholders of two companies in the matrices have the same ownership (either state-owned or non-state-owned)=1, otherwise 0; (2) state-controlled networks: two companies have the same ultimate controller in the matrices (either the state or non-state)=1, otherwise 0; (3) different

Table 1 Descriptive statistics of all individual level variables

Variable	Time	%	N	Variable	Time	%	N
Interlocking directorate relations	00–10	.77	11172	East China	99–09	.39	11172
Largest shareholder	99–09	.62	11172	Central South	99–09	.23	11172
State control	03–09	.66	7974	Southwest	99–09	.10	11172
Central government control	03–09	.09	6074	Northwest	99–09	.06	11172
Provincial government control	03–09	.21	6074	Real estate	99–09	.07	11172
City government control	03–09	.20	6074	Industrial manufacture	99–09	.58	11172
County government control	03–09	.04	6074	Public services	99–09	.09	11172
Nongovernment control	03–09	.47	6074	Finance	99–09	.01	11172
North China	99–09	.14	11172	Commerce	99–09	.08	11172
Northeast	99–09	.08	11172	Hybrid business	99–09	.17	11172
Variable	Time	Mean		SD	Min	Max	N
Total assets (log)	99–09	21.34		1.13	14.94	29.91	11172
Age	99–09	10.08		4.38	1	28	11172
Debt-to-Asset ratio	99–09	.46		0.18	0	1.00	11172
ROE	99–09	.13		1.76	−.10	159.90	11172

Note: To save space, *99* indicates 1999, *09* represents 2009, and so on

administrative levels of government-controlled networks: the ultimate controllers of two companies are at the same administrative level=1, otherwise 0.

Regional networks
Two companies located in the same region in the matrices=1, otherwise 0.

Industry networks
Two companies are in the same industry in the matrices=1, otherwise 0.

As for continuous independent variables, the construction of dyad-level variables must consider the magnitudes of attribute variables (Dreiling and Darves 2011).

Total asset networks
The relations between two companies in the matrices follow $K = \sqrt{lnC_a \times lnC_b}$, C_a and C_b represent the total assets of company a and company b before taking the form of logarithm; when the sum of C_a and C_b is constant, the larger the value of K, the more similar the two companies' total assets.

Age networks
$A = \sqrt{A_a \times A_b}$, A_a and A_b represent the age of company a and company b; when the sum of A_a and A_b is constant, the larger the value of A, the more similar the two companies' age.

Debt-to-asset ratio networks
$D = |D_a - D_b|$, D_a and D_b represent the debt-to-asset ratios of company a and company b; the smaller the value of D, the closer the two companies' debt-to-asset ratios.

ROE networks
$R = |R_a - R_b|$, R_a and R_b represent the returns on equity of company a and company b; the smaller the value of R, the closer the two companies' returns on equity.

Analytic strategy

For individual level dependent variables, one cannot simply adopt a general linear regression model to conduct parameter estimation, the reason being that since interlocking directors connect different companies to form interlocking directorate networks, all company samples are not independent of each other. In this case, using the Ordinary Least Square method (OLS estimates) to estimate the parameters of network data models is invalid.

We adopted the bootstrap method to conduct regression analysis. Bootstrap is a resampling and estimating method based on the sample through setting up random seeds and repeatedly executing permutations of the elements in the vector. Doing so allows consistent asymptotical estimates of the parameters in the case of samples that are not independent of each other. Since attribute level dependent variables are dichotomous, we used bootstrap logistic regression to conduct model fitting, as shown below:

$$\text{Logit}(\rho)_i = \beta_0 + \beta_1 \, \text{ownership}_i + \sum \beta_j \text{others}_j + t_i + \varepsilon_i \tag{1}$$

In Eq.1 (1) ρ is a dichotomous variable indicating whether company i has constituted interlocking directorate relations; *ownership* is the treatment variable, *others* represent other control variables, t represents year control variable, β represents the coefficients to be estimated, and ε represents the random error term. Moreover, to make causal inference more convincing, we ensured that, except for year variables, all explanatory variables are lagged by one period.

The dyad-level dependent variable is the matrix of interlocking directorate networks. As for dyad-level matrix data, we used the Quadratic Assignment Procedure via Semi-Partialling (QAP) to conduct model estimation (Dreiling and Darves 2011; Hanneman and Riddle 2005; Dekker et al. 2003). QAP is like the bootstrap method; it repeatedly executes permutation of the rows and columns of the dependent variable matrix and conducts model estimation after every permutation. For the same coefficient to be estimated, synthesizing the results of repeated estimations can then constitute a QAP distribution. Comparing this distribution with the original estimation results before permutations (usually called the empirical estimation coefficient), the percentage of estimates greater or equal to (or smaller or equal to, in the case of negative coefficients) the empirical estimation coefficient in all estimates constitutes the QAP statistics. Based on QAP statistics and the initially set confidence level, one can determine whether the regression coefficients show any statistical significance in the sense of QAP distribution. The model is shown below:

$$\rho_{ijt} = \gamma_0 + \gamma_1 \, \text{ownership}_{ijt} + \sum v_i \times \text{others}_{ijt} + \varepsilon_{ijt} \tag{2}$$

In Eq.2 (2), ρ represents the probability for enterprise i and enterprise j to constitute an interlocking directorate relation; subscript *ijt* represents enterprise i, enterprise j, and time t, this is a symmetric matrix of $N \times N$; N refers to the number of enterprises at time t; similarly, ownership$_{ijt}$ represents the ownership network of enterprise i and enterprise j at time t, which is also a symmetrical matrix of $N \times N$; others represent a

symmetrical matrix comprised of other dyad-level control variables, γ represents the coefficients to be estimated, and ε represents random error terms.

Results

Companies at the individual level

Table 2 reports the analytic results of individual level variables. Model 1 examines whether companies belonging to the category of "whether the state is the largest shareholder" can constitute interlocking directorate relations. Model 2 examines whether the category of "state is the ultimate controller" can influence the construction of interlocking directorate relations. Model 3 examines the effect of changing mode of supervision and administration of state assets (using the establishment of SASACs in 2004 as a demarcation point) on constructing interlocking directorate relations. Lastly, having deployed the new mode of supervision and administration of state assets (i.e., established SASAC), model 4 examines the different formation mechanisms of the interlocking networks between companies that are affiliated to different administrative levels of government.

The results of model 1 show that the odds of companies with the state as their largest shareholder establishing an interlocking directorate network is 30% higher than those of other companies. This result has also shown high statistical significance regarding QAP, which supports hypothesis 1.

Given that the information from the *CSMAR* dataset about listed companies' ultimate controllers only began in 2004 and considering that the SASAC at the state level was set up in 2003 and regional levels of SASAC quickly followed thereafter, their supervising and administrative effects on state assets would only surface the following year. Thus, in model 2, we recorded year dummy variables, making 2004 the reference group. The results show that the odds of companies with the state as their ultimate controller building interlocking directorate networks is 70% higher than other companies. This result also shows high statistical significance regarding QAP, which further validates hypothesis 1.

Model 3 examines the changing effects state ownership has on interfirm networks before and after the establishment of SASACs. We used 2004 as the demarcation point for year variables to code in a dichotomous dummy variable. This operation after 2004 is denoted as 1, and before 2004 as 0, and this variable is interacted with the largest shareholder variable. We can see that companies whose largest shareholder is the state are 3.05 times more likely to construct interlocking directorate networks after 2004 than before 2004. This result also shows high statistical significance regarding QAP statistics, which supports hypothesis 3. State-owned companies are more likely to construct interlocking directorate networks than non-state-owned companies. This effect was enhanced after the establishment of SASAC at all administrative levels.

Based on model 2, model 4 further differentiates the administrative levels to which SOEs are affiliated. This model shows that compared to non-state-controlled enterprises, the chance for central government-controlled enterprises to build interlocking directorate networks is 2.74 times higher, the chance for provincial government-controlled enterprises is 1.83 times higher, and the chance for city government-controlled enterprises is 1.31 times higher. It is evident that the relationship between the administrative levels to which state-controlled companies are affiliated and their likelihood of building interlocking directorate networks is positive. All these results show high statistical significance regarding QAP.

Table 2 State ownership and interlocking directorate relations: 2000–2010, bootstrap logistic regression

	Model 1		Model 2		Model 3		Model 4	
	Exp(B)	SE	Exp(B)	SE	Exp(B)	SE	Exp(B)	SE
Ownership[a]								
A. Largest shareholder	1.30***	(0.7)			.57***	(.03)		
Largest shareholder × T_{2004}					3.05***	(.19)		
B. State-controlled			1.70***	(.11)				
C. Central government-controlled							2.74***	(.49)
Provincial government-controlled							1.83***	(.20)
City government-controlled							1.31**	(.12)
County government-controlled							.77	(.13)
Year[b]								
2001	1.40***	(.14)						
2002	2.54***	(.30)						
2003	6.61***	(.73)						
2004	6.86***	(.79)						
2005	6.21***	(.70)	.94	(.11)			.91	(.12)
2006	6.12***	(.72)	.94	(.11)			.93	(.14)
2007	6.78***	(.81)	1.09	(.13)			1.04	(.15)
2008	8.46***	(1.0)	1.39**	(.17)			1.21	(.17)
2009	7.19***	(.85)	1.19	(.14)			1.05	(.14)
2010	6.68***	(.81)	1.08	(.13)			.95	(.13)
Region[c]								
North China	1.15	(.14)	1.19	(.18)	1.18	(.14)	1.00	(.19)
Northeast	.79†	(.10)	1.05	(.17)	.75*	(.092)	.85	(.17)
East China	1.43***	(.15)	1.56***	(.21)	1.41***	(.14)	1.34†	(.22)
Central South	.98	(.11)	1.08	(.15)	.96	(.10)	.98	(.17)
Southwest	1.10	(.14)	1.48*	(.24)	1.06	(.13)	1.38	(.28)
Industry[d]								
Real estate	1.04	(.10)	1.05	(.12)	.91	(.08)	1.12	(.16)
Public service	1.11	(.10)	1.05	(.13)	1.04	(.09)	1.01	(.13)
Finance	2.39*	(.88)	2.73†	(1.6)	2.06*	(.74)	2.45	(1.57)
Commerce	1.51***	(.14)	1.75***	(.23)	1.40***	(.13)	1.83***	(.27)
Hybrid business	1.27***	(.09)	1.20*	(.11)	1.16*	(.07)	1.19†	(.12)
Total assets (log)	1.25***	(.03)	1.25***	(.04)	1.30***	(.03)	1.19***	(.05)
Enterprise age	1.02***	(.01)	1.0	(.01)	1.06***	(.01)	1.01	(.01)
Debt/asset ratio	1.19	(.18)	.86	(.16)	1.15	(.17)	.92	(.19)
ROE	1.00	(.05)	.99	(.08)	1.00	(.04)	1.00	(.10)
-2LL	10737.15		6871.64		11196.12		5430.42	
df	25		21		16		24	
BIC	−93147.24		−64559.68		−92781.49		−47258.38	
N	11172		7974		11172		6074	

Standard errors produced by permutation 1000 times using bootstrap are in parentheses. Ownership, region, industry, and other control variables are all lagged by 1 year

†$p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

[a]The reference group for A and B are non-SOEs; the reference group for C is nongovernment-controlled enterprises; other organizations, or privately controlled enterprises

[b]The reference group of year dummy for model 1 is 2000; for models 3, 4, and 5 are 2004

[c]Reference group is northwest; d. reference group is manufacturing industry

However, we also found that there is no statistical significance between county-controlled companies and nongovernment-controlled companies, which could infer that the enthusiasm of lower-level governments to participate in the administration of state-owned companies has decreased. In short, the findings of model 4 support hypothesis 4, i.e., the higher the administrative level to which government-controlled companies are affiliated, the more likely it is that these companies will build interlocking directorate networks.

As for the control variable of region, compared to the reference group of Northwest, those companies located in east China are more likely to build interlocking directorate networks. The coefficient of this variable shows statistical significance through all four models. East China has a long tradition of business culture; especially after the great reform and opening in 1980s, the Yangtze River Delta Economic Zone has become one of the fastest-developing economic regions in China. The analytical results show that interlocking directorate networks are more likely to appear in a fairly developed business environment, in which case, the geospatial mechanism can partially explain the construction of interlocking directorate networks. Based on the companies' dyadic level, the following section further examines whether the geospatial mechanism is valid. In other words, we examine whether companies within the same region are more likely to build interlocking networks than those in different regions.

As for industry variables, three of them have shown statistical significance in our four models: finance, commerce, and hybrid business. Because hybrid business does not have any clear industrial characteristics, we mainly discuss finance and commerce. According to finance control theory, interlocking directorate relations is a social manifestation of financial relations. Within an entire interlocking directorate network, finance departments usually have the most control over the network; hold the money necessary to the operation and production of enterprises; and based on capital flows, can appoint directors to enterprises in debt or being invested in so as to monitor the use of capital. For example, in model 1, the odds of financial enterprises forming interlocking directorates are 2.39 times more likely than industrial enterprises (the reference group).

As shown in Table 2, the reason that commerce enterprises have a greater propensity for building interlocking directorate networks is because they are more sensitive to changes in the supply and demand of the market compared to manufacturing enterprises (the reference group). They thus have a greater need to have a stable system to reduce market uncertainties. This is also a core mechanism of resource dependence theory. For example, wholesale and retail businesses are particularly sensitive to any information about supply and demand in the market; they can use interlocking directorate networks to obtain such information so as to reduce market uncertainties.

The variable of total assets is used to measure the size of an enterprise. All four models in Table 2 show that the more assets companies have, the more likely it is that they will construct interlocking directorate networks. This characteristic also shows high statistical significance in regard to QAP statistics. These findings support resource dependence theory in that major and wealthy companies are more likely to become the source of resources that other companies rely on. In order to reduce this reliance, other companies try to establish interlocking directorate relations with these companies.

For the age variable, based on the prediction of resource dependence theory, the longer an enterprise survives in the market, the more likely it is for them to become a source of resources that other enterprises depend on and, as a result, more likely to

constitute interlocking directorate relations. When using the largest shareholders as the index to measure state ownership (models 1 and 3), the age variable shows high statistical significance in regard to QAP. When using ultimate controller variables as an index to measure state ownership (models 2 and 4), the age variable no longer shows any statistical significance regarding QAP. This means that resource dependence theory is not reliable when it comes to predicting the effects of the age variable. Once the models identify the ultimate controllers of companies, the constitution of interlocking directorate networks is no longer influenced by the age of an enterprise.

Return on equity (ROE) is a typical index for evaluating the performance of enterprises. According to resource dependence theory, those enterprises performing well in the market become the source of resources that other companies depend on, which indicates a great possibility of constructing interlocking directorate relations. However, in all models of Table 2, the coefficients of ROE do not show any statistical significance in regard to QAP. This may indicate that when a company decides to establish interlocking directorate relations with other companies, the priority is not a company's market performance but other characteristics of the company, such as property rights, industry, and firm size. In this case, resource dependency theory has no explanatory power about the effect of ROE on building network relations.

The last variable is debt-to-asset ratio. This variable depicts the debt levels of enterprises. According to supervision and control theory, in order to ensure the safety of investments companies' creditors appoint directors to supervise the operation of companies and further achieve the purpose of controlling companies. The more debt a company owes, the more likely for its creditor to intervene in the running and decision-making of the company. However, in the four models of Table 2, the coefficients of debt-to-asset ratio show no statistical significance. Consequently, at an individual enterprise level, the results do not support the predictions of supervision and control theory.

Companies at the dyadic level

At the interfirm level, the analytic unit is network dyads. We used three models to examine related propositions. The first is the benchmark model (see Table 3). Because the information on largest shareholders is fairly comprehensive (2000–2011), we mainly used this index to conduct QAP analysis, investigating the relationship between the types of companies' ownership and interlocking directorate networks. In contrast, the information about companies' ultimate controllers is lacking. As a result, at the dyadic level, models 2 and 3 are mainly for examining the robustness of the relationship between companies' ownership and interlocking directorate networks (see Tables 4 and 5). Also, because the dependent variables in Tables 3, 4, and 5 are all 0–1 interlocking network relations of dyad companies, we used logistic regression analysis to examine the hypotheses, based on the QAP method.

1. Benchmark test

Table 3 shows that companies that have the same type of largest shareholders (state owned or not) are more likely to construct interlocking directorate networks. Notably,

though, this relationship does not occur randomly, which shows statistical significance in the sense of QAP. Especially, after the establishment of SASAC in 2003, the odds for listed companies of the same ownership to construct interlocking relations improved significantly, and the boundaries between different types of ownership become clearer. For instance, in 2003, the odds between companies whose largest shareholders are of the same ownership constructing interlocking directorate networks are 21% higher than companies with different types of ownership. This relationship shows statistical significance in regard to QAP. In 2008, this number reached 43%, which also shows statistical significance regarding QAP (see Table 3). In short, these results support hypothesis 2, i.e., from the perspective of convergence of organizational behavior companies with the same ownership are more likely to constitute interlocking directorate networks.

In regard to control variables, according to resource dependence theory, the wider the gap between two companies' total assets, the wider the gap between two companies' age, or the wider the gap between their ROEs, the more likely it is for them to build interlocking networks. The reason is that small-sized companies, very young companies, and companies that struggle to survive in the market are more likely to form a dependency on companies that are large in size, have a long history and have constantly performed well in the market. The results of Table 3 show that interlocking directorate networks are more likely to be built between companies that are similar in total assets and age. Especially for the network variable of total assets, in all years, the effect shows statistical significance in regard to QAP; there is a 30% higher chance for companies with a similar amount of total assets to constitute interlocking directorate networks than companies with a significant asset gap (see Table 3). However, the discrepancy between two companies' market performance basically has no influence on the construction of interlocking directorate relations. Overall, the analysis of dyadic relations between companies does not support resource dependence theory.

As for debt-to-asset ratio, supervision and control theory predicts that interlocking directorate networks are more likely to be established between companies that have a significant gap in terms of debt-to-asset ratio. In Table 3, we find that there are only 2 years out of the 11 years from 2000–2010 in which the construction of interlocking directorate networks is more likely to occur between companies that have a significant debt-to-asset ratio gap. In contrast, in 2007 companies with a similar debt/asset ratio were more likely to build interlocking relations. No other results have any statistical significance in regard to QAP. In brief, the predictions of supervisory control theory are not supported by this study.

As for industry variables, collusion theory points out that in order to avoid fierce competition, strengthen communications and contact, and promote cooperation, companies in the same industry will build interlocking relations. Table 3 shows that in 9 of the 11 years (2000–2010), interlocking directorate networks are more likely to be built between companies in the same industry. This effect shows statistical significance regarding QAP. Basically, this finding supports the prediction of collusion theory in that companies in the same industry are more likely to construct interlocking networks.

For region variables, analysis at the individual level of companies (see Table 2) illustrates the high probability of constructing interlocking directorate networks within regions (i.e., East China), whereas the results in Table 3 further support the prediction of geospatial mechanism. Through all the observational years, there has always been the

Table 3 Networks of the state as the largest shareholder and interlocking directorate networks: 2000–2010, QAP logistic regression

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Largest shareholder networks	1.11	1.08	1.22*	1.21***	1.34***	1.28***	1.34***	1.41***	1.43***	1.36***	1.10†
Regional networks	5.88***	5.33***	6.14***	6.06***	5.27***	5.11***	4.45***	4.55***	4.69***	4.19***	3.86***
Industry networks	1.17	1.17	1.28*	1.25***	1.20**	1.20***	1.20**	1.27***	1.27***	1.21***	1.25***
Total asset networks	1.48**	1.58***	1.45***	1.41***	1.4e + 05***	1.38***	1.44***	1.34***	1.33***	1.33***	1.33***
Age networks	1.24***	1.18***	1.09***	1.05***	1.5e − 47	1.05**	1.04**	1.04*	1.03***	1.02*	1.01
Debt/asset networks	.29*	1.23	.73	.96	.76	1.02	1.20	1.42*	.90	.83	.72*
ROE networks	.62	1.01	1.23†	.90	1.11	.69	.84	1.02	.91**	.99	.87†
Intercept	3.7e − 08	9.8e − 09	2.0e − 07	4.4e − 07	2.9e + 103	6.9e − 07	2.4e − 07	1.2e − 06	1.5e − 06	1.8e − 06	2.2e − 06
Number of dyads	5191920	825372	311922	1017072	967272	1184832	1029210	287090	1680912	1536360	1472582
Pseudo R^2 (%)	7.30	6.10	6.80	6.30	5.50	5.30	4.80	4.70	5.00	4.30	3.70
LL	−1918.89	−3093.15	−2595.55	−8545.81	−8121.00	−9640.95	−8317.07	−10297.97	−13471.71	−12254.76	−11132.60

The coefficients in the table are all odds ratios. All models have 500 occurrences of random permutation. All network independent variables are lagged by one year.
The one-tail test of QAP distribution, †$p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 4 State as the ultimate controller and interlocking directorate networks: 2004–2010, QAP logistic regression

	2004	2005	2006	2007	2008	2009	2010
State-controlled networks	1.51***	1.45***	1.42***	1.35***	1.50***	1.55***	1.58***
Regional networks	5.26***	5.12***	4.47***	4.55***	4.69***	4.20***	3.87***
Industry networks	1.21**	1.21***	1.20**	1.27***	1.27***	1.21***	1.24***
Total assets networks	$1.1e+05$***	1.36***	1.42***	1.33***	1.31***	1.31***	1.30***
Age networks	$1.7e-46$***	1.05**	1.04**	1.03**	1.03***	1.02†	1.01
Debt/asset networks	.76	1.02	1.20	1.40*	.90	.85	.76†
ROE networks	1.10	.68	.81	1.02	.91**	.99	.88†
Intercept	$1.3e+101$	$8.8e-07$	$3.1e-07$	$1.4e-06$	$1.8e-06$	$2.4e-06$	$2.9e-06$
Number of dyads	967272	1184832	1029210	1287090	1680912	1536360	1472582
Pseudo R^2 (%)	5.60	5.40	4.80	4.70	5.10	4.40	4.00
LL	−8112.37	−9630.29	−8312.63	−10303.33	−13463.80	−12234.68	−11094.32

The coefficients in the table are all odds ratios. All models have 500 occurrences of random permutation. All network independent variables are lagged by one year
The one-tail test of QAP distribution, †$p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

possibility for interlocking directorate relations to be established between companies in the same region. This result also shows statistical significance regarding QAP.

2. Robustness test

We first replaced "the largest shareholder network" in the benchmark test with "state control network," which indicates whether the state is the ultimate controller of a company, while keeping other network variables unchanged and reran the QAP analysis to create Table 4. Table 4 shows that in all 7 years, interlocking directorate relations are very likely to appear among companies with the same ultimate controller. This pattern

Table 5 Different administrative levels of government-controlled networks and interlocking directorate networks: 2004–2010, QAP logistic regression

	2004	2005	2006	2007	2008	2009	2010
Government-controlled networks	1.44***	1.52***	1.40***	1.47***	1.49***	1.58***	1.60***
Regional networks	5.25***	5.07***	4.41***	4.49***	4.63***	4.12***	3.80***
Industry networks	1.21**	1.21***	1.20**	1.27***	1.27***	1.21***	1.24***
Total assets networks	$5.3e+04$**	1.41***	1.47***	1.37***	1.37***	1.37***	1.37***
Age networks	$1.3e-43$**	1.04**	1.04**	1.04**	1.03***	1.02*	1.01†
Debt/Asset Networks	.74†	1.03	1.20	1.40*	.89	.83	.74*
ROE Networks	1.09	.66	.85	1.02	.91**	.99	.85†
Intercept	$2.2e+94$	$4.8e-07$	$1.9e-07$	$7.3e-07$	$7.7e-07$	$9.7e-07$	$9.9e-07$
The number of Dyads	967272	1184832	1029210	1287090	1680912	1536360	1472582
Pseudo R^2 (%)	5.50	5.50	4.80	4.70	5.00	4.40	4.00
LL	−8116.70	−9627.90	−8317.00	−10298.00	−13471.30	−12237.80	−11097.30

The coefficients in the table are all odds ratios. All models have 500 occurrences of random permutation. All network independent variables are lagged by one year
The one-tail test of QAP distribution, †$p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

also shows statistical significance in regard to QAP. In other words, in all years, government-controlled companies are more likely to establish interlocking directorate networks with other government-controlled companies than with non-state-controlled companies. This effect is similar to the results of our benchmark test model, which further supports hypothesis 2.

In Table 4, for dyadic-level control variables, the effect of debt-to-asset ratio networks on interlocking networks does not support the prediction of supervision and control theory. The effect of industry networks on interlocking networks supports the prediction of collusion theory. The results of regional networks show that in all years, interlocking directorate relations are very likely to appear within the same region. These results show statistical significance in QAP, which supports the prediction of geospatial mechanism. The analytic results of total asset networks and age networks show that interlocking directorate networks are very likely to appear between companies of similar size and age. These findings do not support resource dependence theory.

Second, we further refined the ownership network variable. The variable "different administrative levels of government control networks" was substituted for "the largest shareholder network" in the benchmark test while other network variables were kept unchanged. We continued the QAP analysis (see Table 5). In the same way, this test produced results consistent with the benchmark test. For the variable of different administrative level controlled networks, among all seven observational years, interlocking directorate relations are more likely to appear between companies with the same type of governmental controller. This result shows statistical significance in regard to QAP. For instance, in 2005, when measured by different administrative level of government control, the odds of companies with the same ownership to construct interlocking directorate networks is 52% higher than cross-ownership interlocking directorate networks (see Table 5). Although cross-administrative interlocking directorate relations are existent, e.g., interlocking between companies controlled by the state council SASAC and companies controlled by provincial SASAC, the analytic results in this study show that interlocking directorate networks are more common between companies controlled by the same administrative level of government. Regardless of the approach by which ownership is measured, the likelihood for companies subject to the same ownership to construct interlocking directorate networks is higher than that for those companies subject to cross-ownership or cross-administrative level of governmental control.

Apart from that, looking at the differences between inside and outside the political system, constructing cross-administrative interlocking directorate networks should be much easier than constructing cross-ownership interlocking networks because the former belongs to connections within the system whereas the latter belongs to cross-system connections. Due to this consideration, we can further categorize four types of interlocking networks: within-system interlocking whose controllers are at the same administrative level, within-system and cross-administrative-level interlocking, cross-system and cross-ownership interlocking relations, and interlocking relations outside of the system. The distribution and evolution of these four types of interlocking relations are worthy of in-depth investigation. Overall, Table 5 supports hypothesis 2; i.e., two companies in the same category of ownership are more likely to constitute interlocking directorate networks.

As for control variables, the results of age networks and total asset networks do not support resource dependence theory, the results of regional networks support geospatial mechanism, the results of industry networks support collusion theory, and the results of debt-to-asset ratio networks do not support supervision and control theory. All these findings are identical with the results of the benchmark test.

Discussion and Conclusion

Interfirm networks are a core mode of corporate governance today. To put it in a vivid way, if the market is an invisible hand and modern enterprise a visible hand, then interfirm networks can be seen as enterprises "shaking hands" with each other. This metaphor indicates the continuous cooperation between enterprises and their mutual trust. It also alerts researchers and enterprise managers to constantly be aware that enterprises are embedded in special social structures and political and economic backgrounds. Activating interfirm networks can lubricate the operation of enterprises and reduce transactional cost. Researchers have conducted plenty of work in the fields of economics, management, and organizational studies investigating the various economic functions of interfirm networks. Sadly, current research is still insufficient regarding the formation mechanism of interfirm networks, especially when integrating perspectives of economic efficiency and institutional backgrounds for a comprehensive investigation.

From a cross-perspective of institutional sociology and political economy, this article emphasizes that interfirm networks do not derive purely from enterprise owners or managers' concern regarding market performance, nor is there any universal organizational theory that can adequately explain the construction of interfirm networks. A country's political and economic characteristics and its legal system play an equally important role in shaping interfirm networks, one that can be more important than economic efficiency.

This paper shows that studies on the construction of Chinese interfirm networks must pay sufficient attention to the boundary effects of enterprise ownership and thoroughly understand the paths through which such effects are brought about. It can be said that in the structure of corporate governance with Chinese characteristics, to a large degree, the formation of interlocking directorate networks between state-owned companies is the result of the state's attempt to increase its control over and influence on important industries and critical fields of the national economy.

At the same time, this article does not deny the explanatory power of market theory since economic efficiency has always been the ultimate goal of any company. As for analytic results, collusion theory and geospatial mechanism are supported whereas resource dependence theory, financial control theory, and supervision and control theory need new evidence to further test. Regardless, this article shows that when investigating the formation mechanism of interfirm networks, the explanations of market theory and institutional theory are complementary.

This study demonstrates that there are still issues worthy of further discussion. The first is cross-ownership interlocking networks. Although our study supports the hypothesis that companies of the same ownership are very likely to form interlocking directorate networks, this does not mean that companies of different ownership cannot establish interlocking relations. How cross-ownership interlocking networks come

about, how their constitutive motivation differs from that of mono-ownership inter-locking networks, and what different influences cross-ownership and mono-ownership interlocking networks have on firm performance are questions in need of detailed discussion when looking at the constitutive nature of interfirm networks.

The second issue is the changes brought by the mixed ownership reform. The Third Plenary Session of the 18th Central Committee of CPC has clearly put forward the need for actively developing an economy based on mixed ownership. One can foresee that as mixed-ownership enterprises controlled by non-public capital begin to emerge, there will be new members on boards of directors nominated by non-public capital, not merely nominations by all administrative levels of SASACs or the State-owned Assets Authoring Management Agency. The formation and construction of interlocking networks will also change. Whether these changes are beneficial to corporate governance and improve the performance of mixed-ownership enterprises requires further study.

The third issue concerns the social function of interlocking directorate networks. Kono et al. (1998) argue that localized interlocking directorate relations are more likely to be an elite formation mechanism. Our study shows that regionally localized interlocking directorate networks are widespread in China. As a result, one question worthy of additional study is to determine whether localized interlocking directorate networks promote the cohesion of business elites or whether elite cohesion (e.g., co-membership in business clubs) promotes the formation of localized interlocking networks.

Lastly, although this article has incorporated time into the mechanism of network formation, it merely provides a static comparison of 11 years. Future studies can utilize the method of dynamic network analysis to model the network evolution so as to strictly test propositions regarding the formation mechanism of interfirm networks.

Endnotes

[1]State-owned enterprise is a broad concept; if unspecified, the SOEs in this article all refer to SOEs after the enterprise system reform in China in the 1990s.

[2]"The Company Law of People's Republic of China" announced in 2005 specifies that the ultimate controllers of an enterprise do not have to be shareholders; individuals can become ultimate controllers of an enterprise through investment relations, agreements, or other business arrangements.

[3]Article 53 of "The People's Republic of China Civil Servant Law" (January 1, 2006) indicates: civil servants cannot participate in profitable activities and take up positions in enterprises or other profit organizations.

[4]Here, an appointment is not equivalent to an executive order but achieved through the elections of the general meetings of shareholders.

[5]A few state-owned corporations have their leaders directly appointed, dismissed, and assessed by the central government organization committee; these corporations are not included in this article's discussion.

Publisher's Note

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