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SOCIAL NETWORK ANALYSIS OF KOREAN CONGLOMERATES BASED ON INTERNAL TRANSACTIONS

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Abstract. *The economic growth of South Korea has been largely attributed to Korean conglomerates (also known as "Chaebol"). Thus, the influence of Chaebol on the Korean economy has attracted a fair amount of attention. In this paper, social network analysis (SNA) methods have been applied to the networks of the top three Korean Chaebol, and networks have been constructed based on their internal transactions. The results showed that Korean Chaebol networks have high degrees of density and centralization. This paper demonstrates that SNA techniques can be used in the empirical research and analysis of the internal transactions of Korean conglomerates.*
Keywords: Social network analysis, Internal transactions, Korean conglomerates, Chaebol

1. **Introduction.** The conglomerates of South Korea, known as Chaebol groups, have exerted enormous influence upon the country's fast-growing economy [1]. Influential accounts of Korea's growth have put Korean conglomerates at the center of country's economic transformation [2]. Although Chaebol operations have been a controversial issue in Korea [3], their influence on the Korean economy is worth paying attention to [4]. In spite of their importance, little attention has been paid to the network aspects of Korean Chaebol's internal transactions.

The objective of this paper is to analyze the internal transactions of Korean Chaebol by using social network analysis (SNA) methods. First, internal transaction data of top three Chaebol – Samsung, Hyundai Motors, and SK – were collected for last three years and transformed into networks. Then, the structure of networks was analyzed with respect to various perspectives. In particular, the dynamic perspectives of Chaebol networks were investigated.

2. Methodology.

2.1. Social network analysis (SNA).

A social network is a complex pattern of interpersonal social ties whereby the presence of a tie between parties serves as a conduit for information and resource flow [5]. SNA is concerned with relationships and flows between nodes that represent people, groups, organizations, computers, URLs, etc. In SNA, links show relationships or flows between the nodes. Unlike traditional social science studies, network analysis focuses on the relations among actors – not individual actors and their attributes [6]. Table 1 summarizes the key concepts of SNA.

2.2. Research methods.

To construct a social network, internal sales and purchases data between Chaebol affiliates was preprocessed in a matrix format as shown in Table 2. Actors (nodes) and relations (edges or ties) define network data. In this paper, a node represents a company and a tie represents an internal transaction between nodes.

TABLE 1. Glossary

Node (Actor)	An object that may or may not be connected to other objects in a network. In this paper, nodes represent companies in Korean Chaebol groups.
Tie (Link)	A connection between two nodes that can be either one-way or two-way. In this paper, all ties (e.g., between companies within a Chaebol group) are two-way because transactions can happen in both directions.
Centrality	Centrality measures can identify the most prominent actors that are extensively involved in relationships with other network members. Centrality indicates one type of importance of actors in a network [7,8].
Centralization	Centralization measures how node centralities are distributed. It is a network level measurement, while centrality is a node-level measurement. The higher the centralization is, the more centralized the network is.
Clustering Coefficient	If a neighbor is defined as a livestock operation in direct contact with the operation of interest, the clustering coefficient represents the proportion of one's neighbors who are also neighbors [10].
Reciprocity	Reciprocity is a measure of the likelihood of vertices in a directed network to be mutually linked [9].

TABLE 2. Internal transaction data

From \ To		Purchases			
		A	B	C	D
Sales	A	–	10	15	50
	B	23	–	25	44
	C	32	40	–	35
	D	33	37	26	–

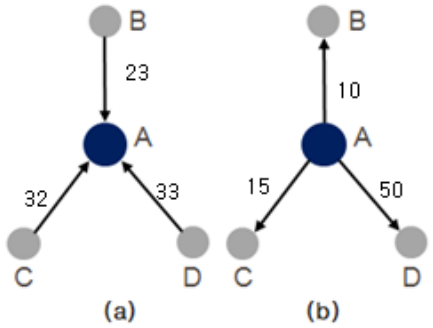

FIGURE 1. Example of internal transaction networks

Suppose that four companies of a specific Chaebol group and their internal sales and purchase data can be represented as in Table 2, and then a network can be constructed as shown in Figure 1 [11]. Note that each node represents a company. For example, node 'A' represents company 'A'.

In Figure 1 and Table 2, two types of transactions are identified from A's standpoint. One is incoming transactions that represent company A's purchases from other companies, illustrated in Figure 1(a). The other is outgoing transactions that represent company A's sales to other companies, illustrated in Figure 1(b). In this paper, the internal transaction

data of the top three Korean Chaebol from 2013 to 2015 were collected. The data has been preprocessed and converted into a network format as shown in Figure 1 and Table 2. After preprocessing, SNA methods could then be applied to the network data. UCINET 6.X has been utilized for the analysis.

3. **Results.** In this section, the results of network analysis on the top three Korean Chaebol – Samsung, Hyundai Motors, and SK – are presented. By using the constructed networks for the top three Korean Chaebol from 2013-2015, various network indices such as centralization, density, reciprocity, and clustering coefficients can be obtained and their trends analyzed.

3.1. **Samsung.** As shown in Table 3, the number of companies within the Samsung Group has decreased during 2013-2015. This was mainly due to restructuring efforts, but network measures such as density, centralization, and clustering coefficients illustrate that internal transactions were more centralized and strengthened during the period. Figure 2 illustrates Samsung's network. There is a group of a few central actors here (S01, S48, and S09) and many peripherals.

3.2. **Hyundai motors.** During 2013-2015, Hyundai Motors Group's network exhibited similar patterns to Samsung's network. The number of companies in the group decreased but its network centralization, density, and clustering increased. The network's centralization is illustrated in Figure 3, which shows a few key actors and many peripherals.

Table 3. Samsung's network

Year	Number of Companies	Centralization (Inbound)	Centralization (Outbound)	Density	Reciprocity	Clustering Coefficient
2013	74	40%	67%	0.16	0.293	0.851
2014	62	41%	73%	0.23	0.321	0.84
2015	56	39%	73%	0.25	0.335	0.835

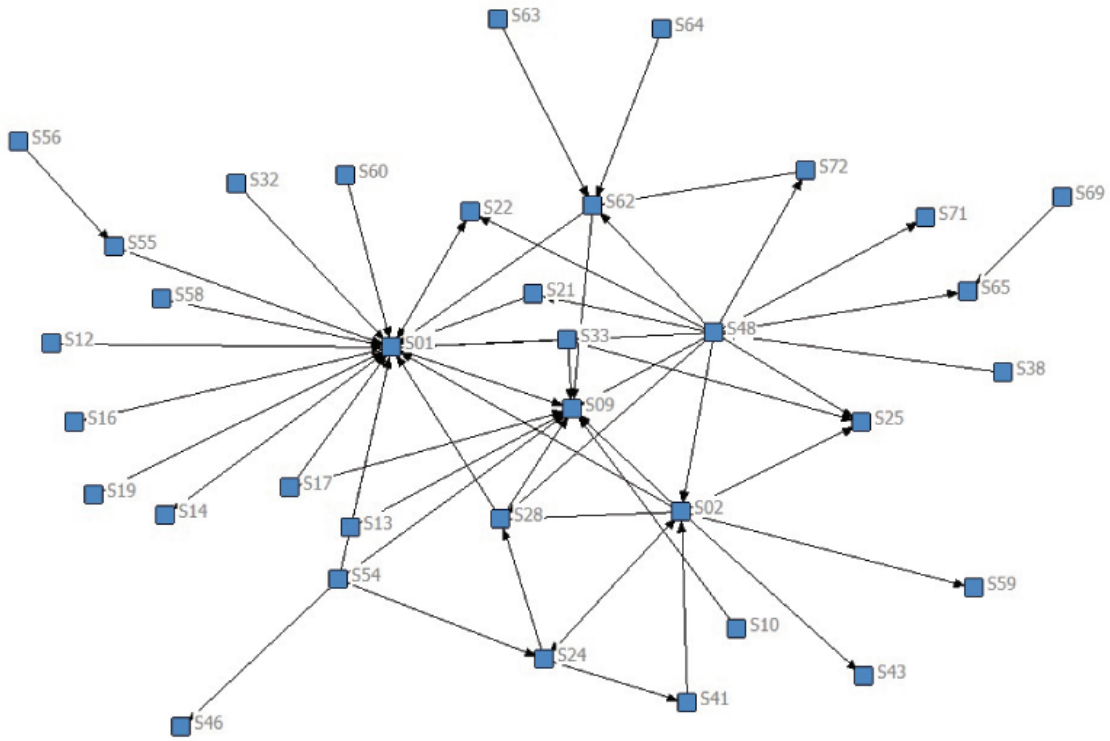

Figure 2. Samsung's network in 2014: Cut-off value of 50 billion KRW

TABLE 4. Hyundai's network

Year	Number of Companies	Centralization (Inbound)	Centralization (Outbound)	Density	Reciprocity	Clustering Coefficient
2013	57	43%	61%	0.169	0.323	0.779
2014	44	47%	66%	0.241	0.345	0.803
2015	49	42%	67%	0.197	0.338	0.801

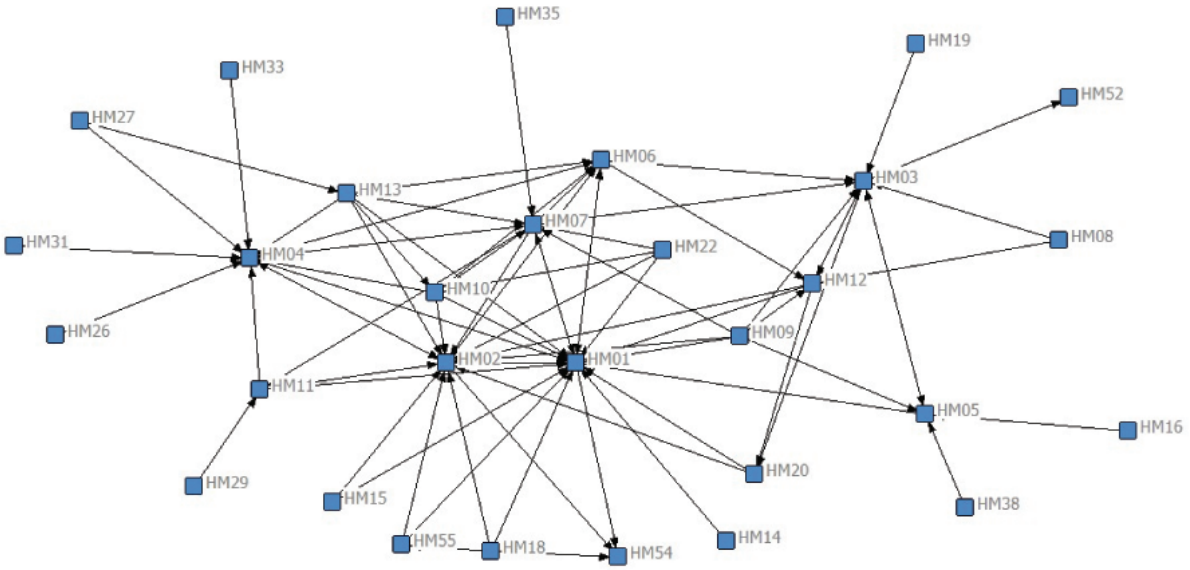

FIGURE 3. Hyundai's network in 2014: Cut-off value of 50 billion KRW

3.3. **SK.** Compared with Samsung and Hyundai, SK's network shows different patterns, as evidenced in Table 5. The number of companies in the SK group has increased from 80 in 2013 to 85 in 2015. Even though density and reciprocity decreased, the clustering coefficient increased. As shown in Figure 4, SK's network topology is similar to that of Samsung and Hyundai, but there is a difference; its inbound centralization is not as high as that of Samsung and Hyundai. However, it has decreased during the period, which shows the purchasing power of SK's central actors is not as high as that of Samsung and Hyundai.

TABLE 5. SK's network

Year	Number of Companies	Centralization (Inbound)	Centralization (Outbound)	Density	Reciprocity	Clustering Coefficient
2013	80	35%	62%	0.149	0.283	0.744
2014	82	32%	64%	0.137	0.275	0.778
2015	85	31%	72%	0.126	0.269	0.787

4. **Conclusion.** In this paper, to analyze network structure of Korean Chaebol, SNA methods were applied to the networks of the top three Korean Chaebol. First, networks were constructed based on internal transactional data during 2013 and 2015. Then, various network measures were utilized to analyze the network structure of different Korean Chaebol. Our network analysis showed that the internal transactions of the top three Korean Chaebol have been strengthened in terms of network density, centralization, reciprocity, and clustering. In particular, outbound centralization increased for the Chaebol, which means centralization became stronger from the seller's standpoint.

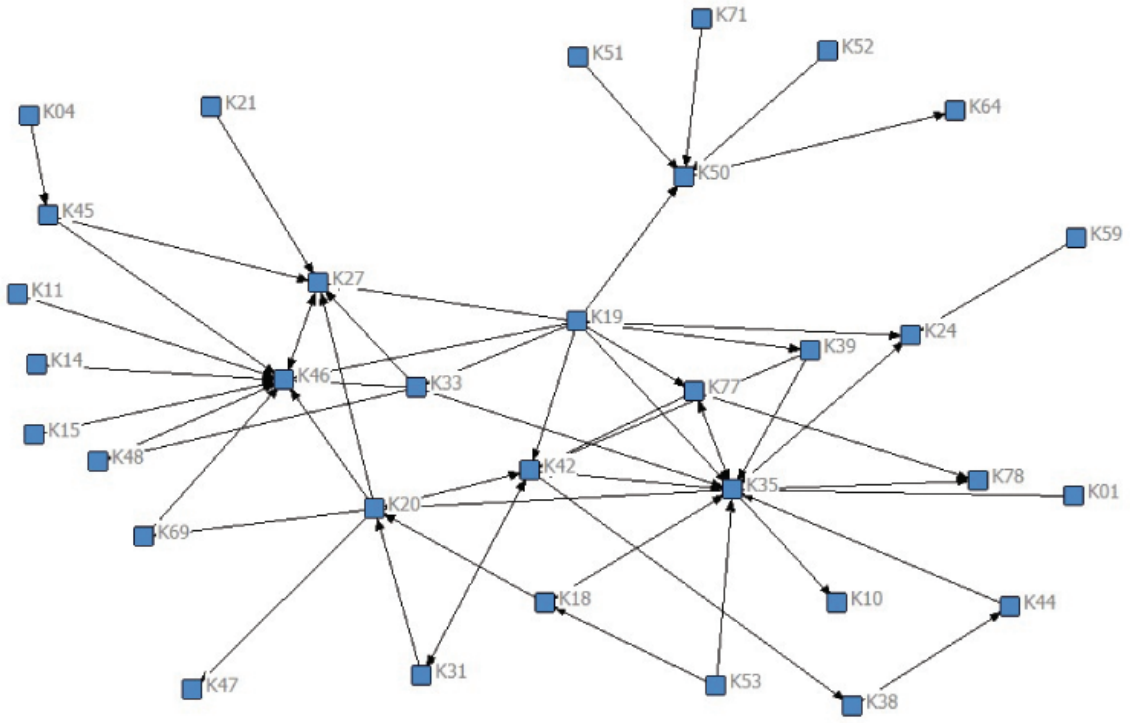

FIGURE 4. SK's network in 2014: Cut-off value of 50 billion KRW

The main contribution of this research was the structural analysis of Chaebol's internal transactions, which provided a "bird's-eye view" of the behavior of Korean Chaebol's internal transactions. In future research, expanding the scope of this study would be promising. Including more Chaebol and expanding the time horizon could show improved results. Moreover, more detailed study on the dynamics of the network would be a suitable topic for future research.

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