Interlocking Directors in Turkey: Small World?[☆]

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Abstract

Interlocking directors connecting the listed firms in Turkey make up a network. The network is bipartite. We analyse the network using network tools. We find that the network is a small-world.

Keywords: `Networks`, Centrality, Small world

[☆]We would like to thank Efe Postalcı for his encouragement and helpful comments while complain about Tübitak for the unscientific attitude.

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1. Introduction

Corporate governance structures can enhance the economic performances of corporations and influence the institutional settings in which the corporations thrive or struggle. Corporate board networks play central roles in corporate governance structures. Owners pick and appoint board members. Board members in turn provide connections among different corporations if they hold positions in more than one board. The social networks formed up due to these connections constrain and affect the corporate governance structures. Overall economic performances of the corporations and the countries are influenced by the corporate governance systems.

The early literature on corporate governance structures has been based on two different frameworks, that of law and politics. According to the first framework, legal origins of the countries (Anglo-Saxon or French) determine the corporate governance structures (La Porta et.al. 1998) . Financial development as a result of and coupled with the legal origins determine the corporate governance structures in each country. The framework based on politics on the other hand argues that social democratic countries with a social accord among workers and owners have different corporate governance structures than the liberal countries (Roe 2004).

Social network analysis offers a unique framework and a methodology over a very central issue that these frameworks could not handle [1] (Kogut and Walker 2001). The issue arises about how the corporate governance structures are coordinated when the ownership is widely distributed and ownership and management is separated. Social network topologies with high clustering and low average path lengths enable such a coordination.

The literature on the intersection of social networks and corporate governance underlines the fact that network configurations and topologies are closely related to the effectiveness of corporate board networks in affecting corporate governance structures. Coordination is achieved, information is diffused and robustness to shocks is maintained through "small network" nature of such net-

works. The literature on corporate board networks uncovers that low average path length and high clustering coefficients of small world networks are typical topological characteristics of corporate board networks. A common factor that leads to higher clustering coefficient in corporate board networks is the existence of business groups of developing countries in which corporations have cross-share holdings or form pyramids of ownership. Naturally, interlocking directors sit in multiple boards of the business groups firms.

In this paper provide a detailed analysis of the interlocking board of directors of Turkish listed firms using tools of social network analysis and its implications from a network perspective. We identify the central players in the Turkish corporate sector by virtue of their position and ties in the network of interlocking directors and firms. We associate centrality positions of directors and firms to the business group configurations. We also search for the existence of small world structure by employing Newman (2003), Robins and Alexander (2004) [2] and Opshal (2013) [3] methods.

2. Corporate Board Networks

According to Collin (1998), interlocking directorates allow business groups to pool information concerning the various members and their managers, thereby improving monitoring by headquarters.

According to Maman (1999), vertical interlocks between group members and parents, grandparents or more remote ancestors are an organizational mechanism for controlling group members. They will especially be useful in large groups employing diversification strategies, which are often associated with control and coordination problems. The purpose of horizontal interlocking on the other hand would be to coordinate sister firms within the group. Horizontal interlocks contribute to maintaining and promoting transactions between group members, to keeping the unity within the group, and to creating a communication network.

Interlocks allow information about technological advances, market opportu-

nities, innovative strategies, etc. to pass among firms in the group. They also decrease transaction costs, facilitate the management of resource flows, serve as a monitoring mechanism, and are a reflection of social cohesion. All firms in a group in which any firms are interlocked will benefit from these interlocks because member firms are tightly connected through other relations. Information passed through the interlocks will continue to spread through these other connections with each other.

The literature on intra-group interlocks leads us to expect that companies belonging to a group have more interlocking directorates than stand-alone companies. The value of intra-group interlocks for the parties involved will tend to be greater than the value of interlocks between unrelated companies.

2.1. Evolution of Corporate Governance in Turkey

2.2. State and Foreign Actors

3. Network Analysis

A network is bipartite if its nodes can be partitioned into two sets such that all edges are between the nodes in partitioned sets and there are no links between nodes within each set. There are three networks we can construct given our data set. First consider the network where a node can represent a firm or an individual. An edge (or a link) in this graph connects an individual to a firm, indicating that the individual either has a seat on the board of directors of the firm or is the general manager of the firm.

Note that this setting allows only links between individuals and firms, but not between individuals, or between firms. It is of course possible that an individual can have seats in different firms, thus have multiple links. The raw data, which consists of firms and board members of these firms, will lead to a bipartite network in which nodes are partitioned according to whether they are individuals or firms.

Degree distributions of nodes in this setting have specific meanings. The degree of a firm is the size of the board of directors of the firm. If the node

is an individual, its degree represents the number of boards she/he is in. Following the literature we can construct two related networks from the bipartite network we defined. In the firm network nodes represent only firms, and an edge between two nodes exists only if there is at least one common member in board of directors. A subset of firms that have links in this manner is referred as interlocked.

In the board of directors network nodes represent individuals, and a link between two nodes exists only if both of the individuals sit on the board of directors of at least one firm.

The firm network and the board of directors network are one-mode projections of the bipartite network. The literature notes that studying these networks as independent structures will be wrong, since the degree distribution of the firms (i.e. size of boards) together with the degree distribution of the directors (i.e. number of boards each director is a member) in the bipartite network will directly affect the degree distribution of the one-mode projection directors network (i.e. number of co-directors) and the firm network (i.e. number of interlocked firms).

The data on the listed firms and the directors is publicly available either in digital or in published form as in *YearBook of Companies*. The main problem with the data is the haphazard nature of the names reported. For instance, Rahmi Koç is reported as "Rahmi M. Koç" as a board member in "Koç Holding A. Ş.", Rahmi Mustafa Koç" as a board member in "TÜPRAŞ", "Mustafa Rahmi Koç" as board member in Arçelik and "Mustafa Rahmi Koç" as a member of "Aygaz A. Ş.". As a vertex in the networks all these names should indicate the same person. Thus standardization and reformatting have been major issues in data management before a thorough network analysis could be carried out. The similar problems arise in terms of the company names with a considerable variation from one year to another.

Having cleaned and standardized the data we obtain a bipartite network with one set of vertices denoting the firms and the other set denoting the directors (board members). The table 3 provides general statistics based on these the

bipartite networks.

Table 1: Bipartite Statistics

Bipartite Statistics	2002	2007	2013
Number of Firms	301	336	435
Number of Directors	1581	1762	2635
Number of Components	135	150	177
Total Number of Seats (number of edges)	2006	2223	3330
Mean Director Degree (mean firm board membership)	1.269	1.267	1.264
Mean Firm Degree (mean board size)	6.664	6.646	7.655
One board directors	1311	1466	2184
Two board directors	180	210	306
Three board directors	51	40	89

The number of firms increased by a % 44.5 from 2002 to 2013. The number of directors (board members) went up by % 66 in the same period. The gap is partially explained by the increase in average board size from 6.66 to 7.65. About % 83 of the directors are board members in only one company so they do not connect any firms via interlocking directorships.

Table 2: Bipartite Giant Component Statistics

Bipartite GC Statistics	2002	3007	2013
Number of Firms	101	100	157
Number of Directors	498	530	964
Total Number of Seats (number of edges)	731	770	1345
Mean Director Degree (mean firm board membership)	1.468	1.453	1.395
Mean Firm Degree (mean board size)	7.24	7.77	8.56
One board directors	373	411	743
Two board directors	69	66	134
Three board directors	25	21	50

The largest connected component (Giant Component, henceforth GC) of the three bipartite constituted % 33 of the original bipartite network in 2002 and % 36 in 2013. The Table 3 displays that within the bipartite giant components board sizes are slightly greater than the original bipartite networks. The average board size is 8.56 in the giant component in 2013, implying one more person in the boards. The ratio of one board directors declines considerably in the giant component networks. In 2002 for example % 74 of the directors hold a single

board membership in the giant component network compared to % 84 in the original bipartite network

The clustering coefficients for one-mode networks are a measure of cohesion or group formation. These measures are defined around triplets (i.e., three nodes with at least two ties among them) and whether or not these triplets are closed (i.e., they form part of a triangle). Two-mode networks are often projected onto one-mode networks to be analysed. These networks often contain many more triangles than prototypical networks, and thus overestimates the level of clustering in a network. Methodological issues exist at a local level as well. Specifically, when calculating the local clustering coefficient (Watts and Strogatz, 1998) or the structural holes measure constraint (Burt, 1992) on projected two-mode networks, the measures are inversely correlated with nodes' two-mode degree on a randomly tie reshuffled two-mode network (each node maintains their degree).

In order to overcome this bias, a number of clustering coefficients for two-mode networks have been proposed in the literature (Opsahl, 2013; Robins and Alexander, 2004). The first set of clustering coefficients for two-mode networks are based on 4-cycles, which is the smallest possible cycle in two-mode networks. For example, Robins and Alexander (2004) defined a coefficient as the ratio between the number of 4-cycles and the number of 3-paths. This measure is illustrated in Panel A of the diagram to the right. The solid lines represent a 3-path and the count of these in a network would be the denominator. If the dashed line was present, the 3-path would be closed and part of a 4-cycle. The count of these would be the numerator. Formally, this coefficient is:

$C_{RA} = \frac{\text{number of closed 3-paths}}{\text{number of 3-paths}}$

Although this could be viewed as a form of clustering, it would not be triadic closure as it includes only two individuals. In fact, it could be considered a measure of reinforcement between two individuals rather than clustering of a group of individuals.

The fundamental purpose of the one-mode clustering coefficient was to detect closure among three nodes. Based on this concept, Opsahl (2013) proposed a

Table 3: Bipartite Clustering Coefficients

Bipartite CC	2002	2007	2013
CC_{RA} BP	0.27	0.30	0.29
CC_{OP} BP	0.40	0.413	0.427
CC_{RA} GC	0.19	0.21	0.20
CC_{OP} GC	0.31	0.36	0.347

new coefficient for two-mode networks that measures closure among three nodes from the primary node set instead of only two primary nodes (e.g., Robins and Alexander, 2004). Specifically, the denominator and numerator of the one-mode global clustering coefficient can be redefined in terms of 4-paths and closed 4-paths, respectively. This is due to the fact that all 4-paths in a two-mode network are 2-paths in a one-mode projection of the network; however, not all 2-paths in a one-mode projection are created from 4-paths. In fact, 2-paths can also be created due to multiple nodes being connected to the same node. The 2-paths created by the latter mechanism would be excluded when only considering 4-paths in the two-mode structure. This feature is illustrated in Panels A and B of the diagram to the right. In the first panel (A), there are five 4-paths, three of which are closed. These 4-paths represent five 2-paths in the one-mode projection (panel B). However, in the one-mode projection, there are an additional three 2-paths. These are created among node 2, node 3, and node 4 as these nodes are all connected to node C in the two-mode network. The clustering coefficient of the two-mode network (panel A) is 0.6, while the clustering coefficient of the one-mode projection (panel B) is 0.75. Formally, the global clustering coefficient for two-mode networks is:

$$C_{TO} = \frac{\text{number of closed 4-paths}}{\text{number of 4-paths}}$$

where 4-paths that are closed by being part of at least one 6-cycle (i.e., a loop of six ties with five nodes). The Table 3 gives the clustering coefficients of the original bipartite networks and the giant components according to both Robin and Alexander (2004) and Tore Opshal (2013) methods.

Explain the TABLES

The Table 6 is revealing. According to the Robin and Alexander (2004) the

Table 4: Normalized Bipartite Clustering Coefficients

Bipartite CC	2002	2007	2013
CC_{RA} BP	0.27	0.30	0.29
CC_{RA} random	0.0062	0.0035	0.003
CC_{RA} normalized	45	85	97
CC_{OP} BP	0.40	0.413	0.427
CC_{OP} random	0.027	0.023	0.021
CC_{OP} normalized	14.8	17.9	20.3

Table 5: Normalized Average Path Lengths

Average Path Lengths	2002	2007	2013
APL BP	11.09	12.01	13.28
APL random BP	6.92	6.95	6.93
APL BP normalized	1.6	1.73	1.92

small world coefficient has increased considerably from 2002 to 2007. However, Tore Opshal (2013) method results in a much more attenuated change in the small world coefficient. The second method is more reliable as it deals with the clustering issue in the bipartite networks in a more consistent way.

Table 6: Small World Statistics

SW world	2002	2007	2013
SW_{RA}	28.12	49.14	50.52
SW_{OP}	9.25	10.35	10.43

EXPLAIN IN DETAIL

Let A be a matrix of order fxn such that $a_{ij} = 1$ director i sits on the board of company j, $a_{ij} = 0$ otherwise. By using the matrix product we construct the n-square matrix $F = A^T A$, where the off-diagonal entries are the weights of the edges, whereas the diagonal entries are the sizes of the company boards, and the q-square matrix $D = MM^T$, where the off-diagonal entries are the weights of the edges, whereas the diagonal entries are the total number of board memberships. We set all the diagonal entries of F and D equal to zero and all the weights b_{ij} and d_{ij} equal to 1, obtaining exactly the adjacency matrices associated with these graphs.

The Table 10 demonstrates that even though the projected firm networks are

Table 7: Firm Projection Statistics

Firm Projection Statistics	2002	2007	2013
Number of Components	135	150	177
Number of Edges	370	416	536
Number of Firms	301	336	435
Maximum degree	17	17	14
Mean Firm Projection Degree	2.458	2.476	2.461
Mean / maximum possible degree	0.0082	0.0074	0.0057
Clustering Coefficient			
Average path length			

sparse (the mean/max degree is at most 0.058), the networks have high cohesive structures (clustering coefficients are about 0.6) and are reachable within a few steps (average path length is at most 6). The following sections will demonstrate that the giant components of the projected networks are largely the products of the strategic decisions of a small number of business group firms and their directors.

Table 8: Firm Giant Component Statistics

Firm Largest Component Statistics	2002	2007	2013
Number of Edges	265	287	382
Number of Firms	101	100	157
Maximum degree	17	17	14
Mean Firm Projection Degree	5.247	5.74	4.866
Mean / maximum possible degree	0.052	0.058	0.031
Clustering Coefficient	0.57	0.66	0.57
Average path length	5	5.8	6.17

3.1. Directors Networks

Let A be a matrix of order fxn such that $a_{ij} = 1$ director i sits on the board of company j, $a_{ij} = 0$ otherwise. By using the matrix product we construct the n-square matrix $F = A^T A$, where the off-diagonal entries are the weights of the edges, whereas the diagonal entries are the sizes of the company boards, and the q-square matrix $D = MM^T$, where the off-diagonal entries are the weights of the edges, whereas the diagonal entries are the total number of board memberships. We set all the diagonal entries of F and D equal to zero and

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3.2. Central Firms and Directors

We consider betweenness centrality. Basically betweenness centrality is defined by the number of shortest paths (geodesics) going through a certain vertex. A higher betweenness centrality measure for a firm means that any flow, would more likely to pass through that particular firm. The Table 11 shows that

"Türk Pirelli" has the highest betweenness centrality score in 2002. The remaining firms in the list apart from "İzmir Demir Çelik" all belong to business groups.

Table 11: Central Firms in 2002

Top 10 Vertices in Betweenness Centrality, 2002	**Code**	**Value**
Turk Pirelli Kablo Ve Sistemleri A. S.	F454	2022.72
Haci Omer Sabanci Holding A. S.	F232	1887.83
Alarko Holding A. S.	F29	1693.67
Dogan Sirketler Grubu Holding A. S.	F149	1381.43
Omv Petrol Ofisi A. S.	F356	1205.94
Altin Yunus Cesme Turistik Tesisler A. S.	F37	1056.79
Izmir Demir Celik Sanayi A. S.	F268	921.
Izocam Ticaret Ve Sanayi A. S.	F269	904.293
Componenta Dokumculuk Ticaret Ve Sanayi A. S.	F126	810.994
Turkiye Sinai Kalkinma Bankasi A. S.	F463	748.

In 2007, "Otokar" is at the top of the betweenness centrality list. As a "Koç" business group firm it is indeed central as the Figure **??** illustrates. All of the top 10 firms in the list are business group firms. Three of them are from "Koç", two of them are from "Sabancı" and two are from "Doğan".

Table 12: Central Firms in 2007

Top 10 Vertices in Betweenness Centrality, 2007	**Code**	**Value**
Otokar Otomotiv Ve Savunma Sanayi A. S.	F361	2504.62
Dogan Sirketler Grubu Holding A. S.	F149	2277.65
Hurriyet Gazetecilik Ve Matbaacilik A. S.	F240	1923.65
Ford Otomotiv Sanayi A. S.	F203	1494.87
Ege Endustri Ve Ticaret A. S.	F162	1394.
Brisa Bridgestone Sabanci Lastik Sanayi Ve Ticaret A. S.	F104	1343.
Haci Omer Sabanci Holding A. S.	F232	1071.5
Koc Holding A. S.	F294	947.936
Tekfen Holding A. S.	F433	810.775
Akmerkez Gayrimenkul Yatirim Ortakligi A. S.	F20	740.

In 2013, as Table 13 displays "Doğan Şirketler Grubu" becomes the most central firm. The following firm is the flagship bank of the "İşBank" business group, namely "Türkiye İş Bankası". Indeed 5 out 10 firm are part of the "İşBank" business group.

The most central director, Aldo L. Kaslowski was a board member of "Hacı

Table 13: Central Firms in 2013

Top 10 Vertices in Betweenness Centrality, 2013	Code	Value
Dogan Sirketler Grubu Holding A. S.	F149	3539.47
Turkiye Is Bankasi A. S.	F461	2833.06
Anadolu Efes Biracilik Ve Malt Sanayi A. S.	F42	2580.04
Turkiye Sise Ve Cam Fabrikalari A. S.	F464	2463.62
Saf Gayrimenkul Yatirim Ortakligi A. S.	F399	2448.24
Tat Gida Sanayi A. S.	F428	2372.51
Tav Havalimanlari Holding A. S.	F429	2201.3
Denizli Cam Sanayi Ve Ticaret A. S.	F138	1939.
Trakya Cam Sanayi A. S.	F443	1886.83
Soda Sanayi A. S.	F418	1866.74

Ömer Sabancı Holding". Ahmet Vural Akışık is from "Doğan" business group.

Table 14: Central Directors in 2002

Top 10 Vertices in Betweenness Centrality, 2002	Code	Value
Aldo L. Kaslowski	D292	47946.
Ahmet Vural Akisik	D256	46530.1
Ishak Alaton	D2013	35059.6
Caner Cimenbicer	D830	34030.
Erol Sabanci	D1250	30630.4
Nadir Ozsahin	D3099	24909.6
Teoman Yenigun	D4036	24310.
Ferit Bulent Eczacibasi	D1374	22680.9
Mahmut Ekrem Barlas	D2405	21150.
H. Orhan Karabulut	D1535	19941.6

Taylan Bilgel who tops the most central directors list in 2007 is from "Doğan" business group. Table 15 has Bülent Bulgurlu as the director with the second highest betweenness centrality score. Bülent Bulgurlu is professional manager for the "Koç" business group.

According to Table 16 Raif Ali Dinçkök as one of the founders of the "Akkök" business group is the most central director in 2013. Mehmet Ali Berkman is also from the "Akkök" business group. The interesting finding is that Murat Ülker, a more conservative figure from the "Ülker" business group comes as the third. There are four directors from the "Ülker" business group in the top 10 list.

Table 15: Central Directors in 2007

Top 10 Vertices in Betweenness Centrality, 2007	**Code**	**Value**
Taylan Bilgel	D4026	71341.7
Bulent Bulgurlu	D752	70469.3
Mehmet Cem Kozlu	D2544	65450.9
Ali Ihsan Ilkbahar	D370	41230.
Mustafa Bayraktar	D2963	38808.
Guler Sabanci	D1487	30586.2
Recep Yilmaz Arguden	D3545	26570.9
Mustafa Sani Sener	D3028	23520.
Hasan Seymur Subasi	D1717	21869.3
Imre Barmanbek	D1987	18226.7

Table 16: Central Directors in 2013

Top 10 Vertices in Closeness Centrality, 2013	**Code**	**Value**
Raif Ali Dinckok	D3505	0.206298
Mehmet Ali Berkman	D2492	0.206298
Murat Ulker	D2931	0.201338
Tayfun Bayazit	D4021	0.200416
Ahmet Ozokur	D229	0.20025
Ahmet Cemal Dorduncu	D152	0.200166
Mehmet Mete Basol	D2638	0.194782
Ekrem Pakdemirli	D1092	0.194232
Ali Ulker	D425	0.193257
Cengiz Solakoglu	D903	0.192947

4. Business Groups and Cohesion

Corporate board networks are formed by the shareholders, board members and managers through their often strategic business decisions. These networks in return become the basis of the social infrastructure of corporate governance regimes. The corporate board networks are part of the institutional framework of the national economies. The networks of interlocking directors and cross share holdings serve as coordination and competition mechanisms.

Turkey as a developing economy hosts powerful business groups. According to Colpan (2012) [4] out of 50 biggest economic entities ranked by employment in 2005, 28 are business groups owned or controlled by mostly families. The rest are state owned enterprises or foreign multinational firms. State firms accounted % 34 of all employment as they cater for more labor intensive sectors.

Business groups indicate that they benefit mostly enhanced financial capabilities, high quality of human resources and special organizational form, design and strategies. Besides equity ties business group firms interlocking directors hold positions in the corporate boards of the group firms. Control and coordination across business groups firms are maintained through both channels.

Families establish holding companies and use pyramidal ownership structures with or without special share classes to ultimately control and manage the firms in the groups. Family members or close acquaintances as well as senior professional managers dominate the boards at the business group firms.

Corporate governance reforms of the 2000s slightly reduce the weight of the family members in the boards as firms increase the number of independent directors as well as the professional managers in their boards. Even though some of the CEO positions of the holding companies have been given to the professionals the real power stay with the senior figures of the family.

> The functioning of the board of the group holding company in most cases still predominantly followed the voice of the founding family, according to the executives whom we interviewed, not only because non-family board members were still fewer in number and as

> outsiders did not have adequate and concrete information to influence decision-making, but because the family collectively owned the majority of shares of the holding company anyway. (Colpan 2010)

. This is not surprising as the owner-families select and appoint the independent directors and professional managers. Minority shareholders do not have any clout. Formal legal rules or regulations do not reflect the reality in the corporate board networks. For the publicly listed holding companies, then, family control always faces a criticism of minority shareholder exploitation, as long as the board functions in a way to favour only family interests, rather than company interests.

The business groups dominate the corporate board networks. High clustering in the corporate board networks is derived largely thanks to the common board members of the business group firms. Low average path length on the other hand depends on inter-group connections and on ties with stand alone firms.

Koç business group is the biggest private business group in Turkey The origins go back to 1920s when the founder Vehbi Koç began as a trader and subcontractor for State. In 1963, the holding company is established. The third generation of the family is managing the BG. KOÇ BG firms operate in more than 25 sectors. KOÇ BG listed firms operate in 10 sectors.

There are 15 listed KOC BG firms in our sample. KOC BG firms constitute %15 of the total market value in the stock exchange market. KOC BG firms have important foreign partnerships such as with Fiat in Tofaş; with Ford in Ford Otomotiv, with UniCredit in Yapı ve Kredi Bankası.

The second biggest private business group in Turkey The origins go back to 1930s when the founder Hacı Ömer Sabancı began as a trader and textile manufacturer. The holding company was established in 1967 SABANCI BG listed firms operate in 9 different sectors.

There are 13 listed SABANCI BG firms SABANCI BG firms constitute %11 of the total market value in the stock market (BIST) SABANCI BG firms also have significant foreign partnerships with DuPont in SASA, with CitiBank in

AKBANK

ISBANK BG is a bank based business group. The main bank was established by the State in 1925. Currently the main bank is owned and controlled by the pension fund of the employees and retired employees. However, the Republican People's Party has also a stake of %28. ISBANK BG listed firms operate in 6 sectors but 10 of the 16 firms are concentrated in Finance and Glass production (6 in each)

ISBANK BG firms constitute % 6.7 of total market value in BIST. The main bank is critical in the development of other business groups. ISBANK BG is also a pioneer in venture capital projects.

OYAK is a military-run business group. Although the formal owner is the pension fund of the military personnel the top generals have the last word The pension fund was established in 1961 OYAK BG firms mainly operate in Cement, Auto and Finance

The giant component provides the potential small world feature of the corporate governance networks. High clustering and short average path lengths are important for the small world characteristics ([1]) Enforcement depends on clustering. Sharing a common board member definitely requires trust and the rewards or punishments leading to trust in turn necessitate a clustered subnetwork of ties.

Information and behaviour diffuse via short paths. Clustering coefficient is 0.57 Average path length is 6.17 There is a high clustering especially thanks to cliquishness of BG firms However the average path length is higher than other country networks as BGs have few links among each other. Either trust is lacking or there is no advantage to do so!

Top 15 BGs in the giant component make up more than two thirds of the firms There are 157 firms and the total degree is 764 (which is twice the number of links) Top 10 BGs firms have % 74 all the degrees, that is they have 565 degrees collectively.

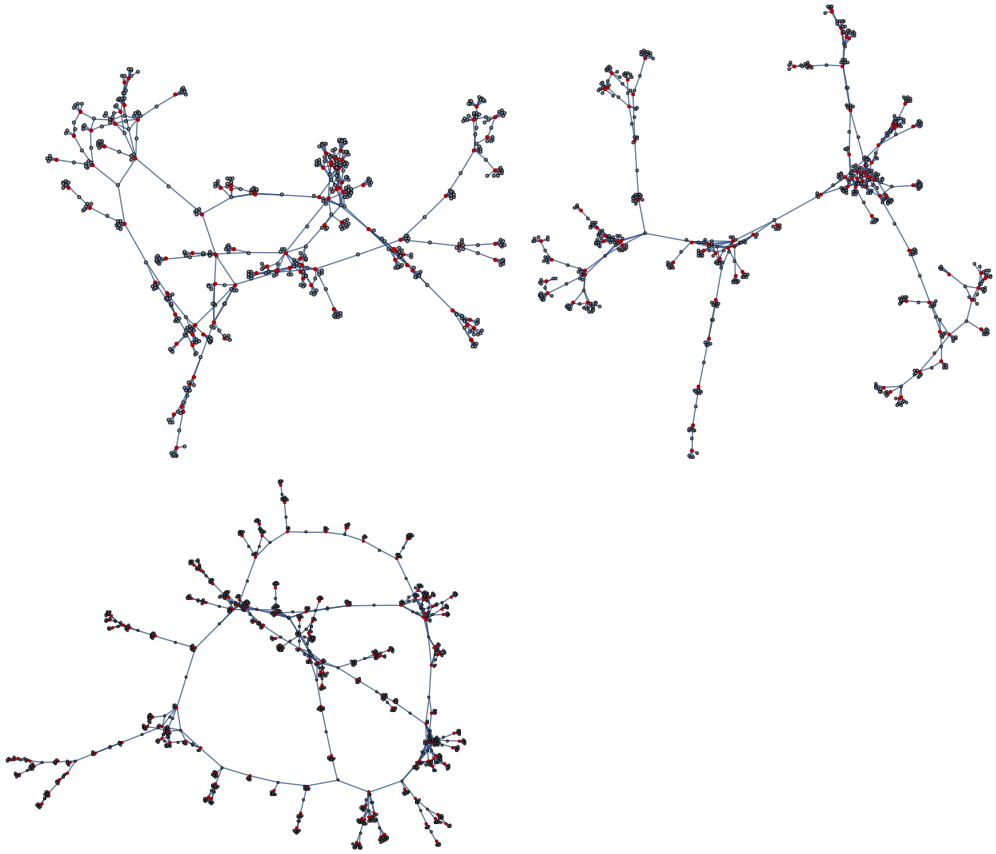
BG firms keep the small world of corporate governance networks through family members and loyal managers BGs collectively constrain the power of

foreign capital. BGs can stand against the excessive intervention of the executive power BGs incubate new start ups in new sectors

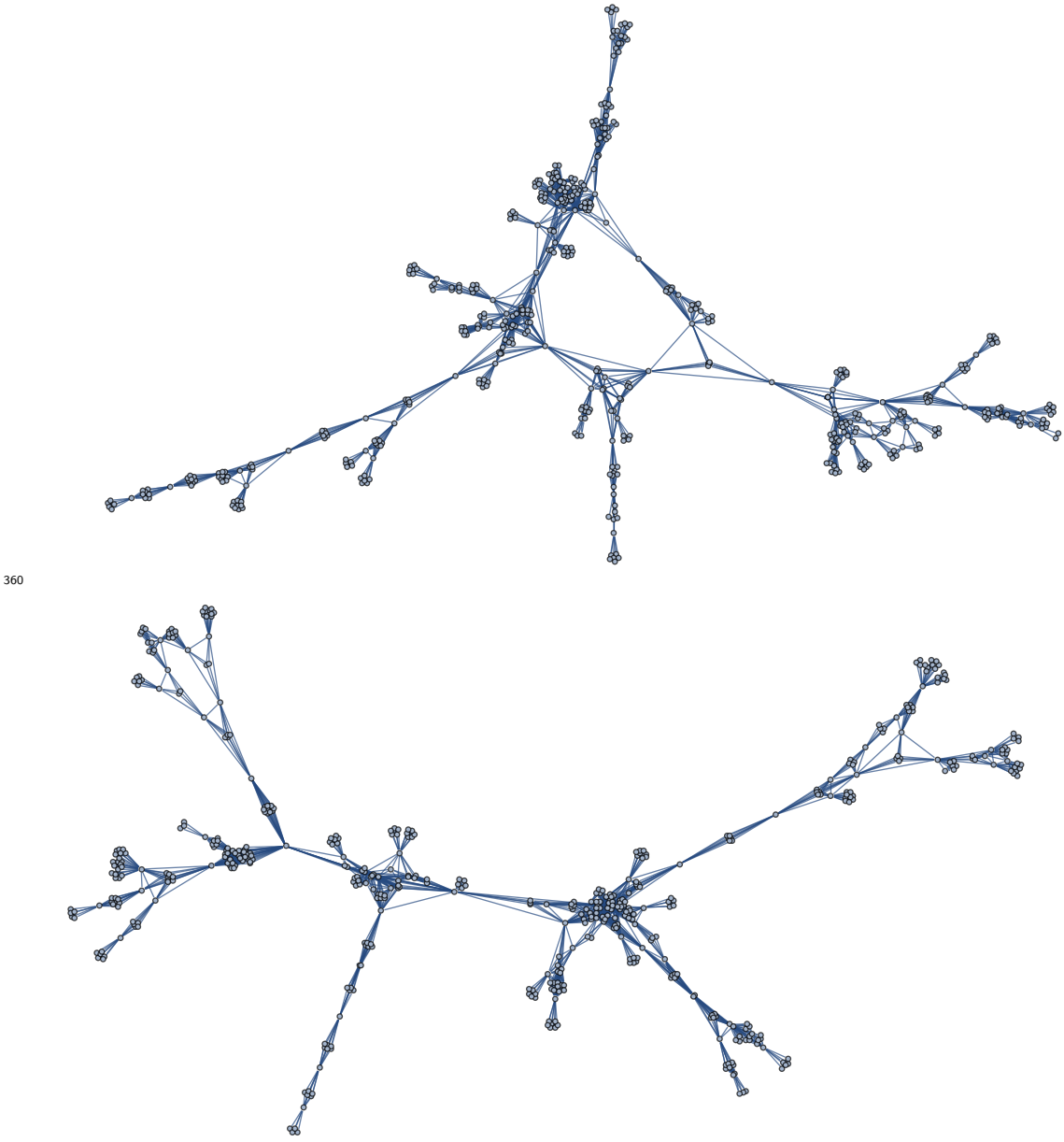
The downside of the dominant BGs is the lack of entry Through their control of capital markets BGs enjoy a huge advantage There should be an optimal balance with BGs and independent/foreign firms.

5. Figures

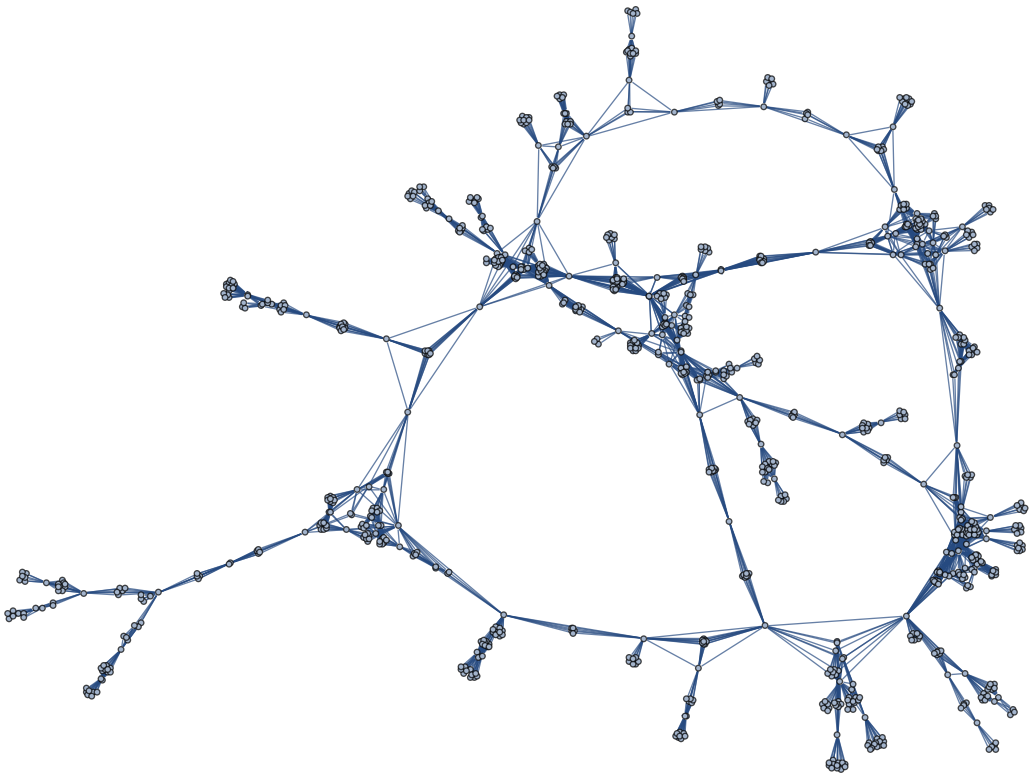
5.1. Bipartite



355 *5.2. Firms*



360



6. Front matter

The author names and affiliations could be formatted in two ways:

(1) Group the authors per affiliation.

(2) Use footnotes to indicate the affiliations.

See the front matter of this document for examples. You are recommended to conform your choice to the journal you are submitting to.

7. Bibliography styles

There are various bibliography styles available. You can select the style of your choice in the preamble of this document. These styles are Elsevier styles based on standard styles like Harvard and Vancouver. Please use BibTEX to generate your bibliography and include DOIs whenever available.

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