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Stand'alone' firms in inter-firm network - An evidence from India

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Abstract

The small world approach of analyzing networks ignore the isolated nodes. The paper studies whether ownership structure like affiliation to business group is related to firms inclusion in the director interlock driven network in India. Using a sample of listed firms in India, I find that group firms are less likely to be isolated in the network vis-a-vis standalone firms.

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1. Introduction

The inter-firm networks have been widely studied in the field of organizational theory, economics, management, sociology, communications and many others. Director interlocks are one of the mechanisms which facilitate formation of inter-firm network. Interlocks are formed when a director serves on the board of more than one firm and as a result the firms also get connected. The interlocked director provides the firm access to larger pool of resources on account of his affiliation with numerous firms (Pfeffer, 1972). Director interlock driven inter-firm network have been found to be important for firm level outcomes like performance (Keister, 1998; Hochberg, 2007; Balasubramaniam et al., 2011; and Larcker et al., 2012), market entry (Hochberg, 2010), executive compensation (Devos, 2009; and Patnam, 2011), governance practice (Bouwman, 2011) and other outcomes.

With the availability of large datasets and sophisticated computer techniques, network researchers have widely applied the concept of 'small world' to describe network structures. Small world is simply the notion that everyone is connected to everyone else in the world. In mathematical terms the small world concept translates into a network characterised by small average path length and high clustering among nodes of the graph (Watts and Strogatz, 1998). The small world property is favorable for faster diffusion of information among the nodes for large networks even if the network density is low. Studies have established that interlock driven inter-firm networks can be characterized as small world (Kogut and Walker, 2001; Davis *et al.*, 2003; and Conyon and Muldoon, 2006).

The small world studies focuses on the giant component of the network. A giant component is the maximal sub-graph whose nodes are connected via a path or alternatively the distance between the nodes is not undefined/ infinity. Analyzing the giant component can be said to be representative of the core structure of the network as it consists of the majority of the nodes. However, most real networks have isolated nodes which are either not connected to any other nodes in the network or they are connected to few nodes which are in turn not connected to the nodes of the giant component. Completely ignoring the isolated nodes does lead to loss of qualitative understanding about the structure of the overall network. It is important to understand whether the isolated nodes within the network are result of some underlying social or economic process or is a random coincidence. If the isolated nodes are result of an underlying phenomenon then analyzing these nodes can make study of networks richer. The study intends to fill this gap in the literature by analyzing whether ownership structure like affiliation to a business group can determine whether a firm constitutes an isolated node in the network formed on account of directors interlocks. The business group as an organization structure is viewed as a response to imperfect markets like underdeveloped capital markets, constraints to availability of institutional credit and scarcity of managerial talent and policy distortions (Khanna and Palepu, 1997; Ghemawat and Khanna, 1998). The group structure helps in risk sharing (Kali, 2003) and diversified group firms often outperform standalone entities in emerging markets (Khanna and Palepu, 2000). This view suggests that business groups should become less important as the economy modernizes and its quality of institutions improves. However, if group firms are more likely to be a part of a connected network, they will have access to larger pool of resources which may positively affect their firm outcomes like performance and research and development activities over time.

The analysis is set up in India for two reasons. Firstly, the corporate governance landscape in India has been evolving during the last decade. All listed companies were mandated

to follow the Clause 49 of the Listing Agreement which is similar to the Sarbanes-Oxley Act of the United States by March 31, 2003. Later to strengthen the regulations; the revised Clause 49 came into force on January 1, 2006. The introduction of the Clause 49 and its subsequent revised version is an exogenous source of variation to the inter-firm network and hence is an ideal candidate to analyze the evolution of network structure on account of changes in the regulatory environment. Secondly, Indian corporate sector has been historically dominated by large business group firms (Mehta, 1955; and Sarkar, 2010).

The study finds that standalone firms are more probable to constitute isolated nodes within the network formed on account of director interlocks in India vis-à-vis business group firms. Identifying the structural properties of isolated nodes can make the network literature richer.

The reaming of the paper is organized as follows. Section 2 describes the data and variables. Section 3 presents the empirical findings and Section 4 concludes the study.

2. Data and Variables

The study is based on the network formed by a sample of 1,539 National Stock Exchange listed firms in India in 2012 and their networks in 2003 as well as 2007. In an attempt to understand the evolution of the inter-firm network on account of director interlocks at different stages of the corporate governance practices followed by Indian firm, we choose three distinct times point i.e. 2012, 2007 and 2003. In addition to the year 2012 which is the latest available year, we choose 2003 and 2007 to focus on firms immediately after the introduction of corporate governance regulations in March 2003, and also in the period post the implementation of the revised regulations in January 2006 respectively. The year 2003 is likely to capture the impact when all listed firms implemented corporate governance regulations for the first time ever, thereafter 2007 marked the first complete financial year when all firms implemented the revised corporate governance regulations in January 2006. The final sample consists of 3,795 firm year observations after excluding firms for director level information or financial data was not available.

The dependent variable in the analysis is the dummy *'isolated node'* which takes the value one if the node is not connected to the giant component of the network and zero otherwise.

Interest variable is a '*group'* dummy which takes the value one if a firm belongs to a business group and zero otherwise.

We control for age, firm size, profitability and board size. Older firms having survived in the corporate sector for a longer period are likely to have an established reputation and it can be connected to several other firms. More number of connections can decrease older firm's likelihood of being isolated from the giant structure. In the regression age variable is defined as the logarithm of age arrived after subtracting the year of incorporation from the financial year of analysis. Further, if firms become large due to economies of scale, easier access to credit, strategic diversification or market power, it is possible that their directors are also efficient or better managers. These good quality directors can be appointed on the boards of several other firms. As a result these firms are less likely to constitute the isolated nodes within the network. We define firm size as the logarithm of total assets in the regression. If firm's profitability is considered as a proxy for quality of director, then more profitable firms are likely to have director interlocks and be part of the network. We use accounting measure of firm profitability given by return on assets. Finally, to rule out the possibility that more number of directors

serving on the firm's board increases its probability of getting connected with other firms through directorial ties, we control for board size effect by including logarithm of board size in the regression. In addition to the above set of controls, we incorporate industry and time dummies in both the analyses in order to control for industry and time specific factors respectively.

Table 1: Descriptive Statistics

Panel A gives the year-wise number of isolated nodes in the network and the distribution of isolated nodes with respect to firm's affiliation to business group, top 50 business groups and standalone entities. The value in parenthesis gives the percentage share of each type of firm among the set of isolated nodes for the given year. Panel B gives the summary statistics of firm specific characteristics for isolated firms and firms belonging to the giant component. Firm size is defined as the logarithm of total assets during the year. Total sale is given by the logarithm of total income of firm. Board size is simply the number of directors on the board of a firm. Age is given by the number of years since incorporation. Return on assets is the ratio of profit before interest and taxes to total assets. The first two columns gives the mean and standard deviation for isolated firms and the last two columns gives the mean and standard deviation of firms belonging to the giant component of the network. The significance of mean is based on two tailed difference of mean t-tests. The significance in variances is based on F-test results. Significance at 1 percent, 5 percent and 10 percent levels are denoted by ****, **, * respectively against the parameter estimate values.

Panel A

	2003	2007	2012
Number of isolated firms	253 (28% of total)	222 (16% of total)	173 (11% of total)
Number of isolated group firms	87	68	59
	(34.39)	(30.63)	(34.10)
Number of isolated group firms belonging to Top 50 business groups	18 (7.11)	9 (4.05)	12 (6.94)
Number of isolated standalone firms	166	154	114
	(65.61)	(69.37)	(65.90)

Panel B

	Isolated nodes		Giant component	
	Mean	Standard deviation	Mean	Standard deviation
Firm size	7.04***	1.72***	8.72	1.89
Total sales	6.56***	2.09***	8.26	1.91
Age (years)	22.88***	17.17***	32.29	23.06
Board size	8.62*	3.39	8.87	3.33
Return on assets	0.14	0.26*	0.13	0.13

Panel A of Table 1 indicates that the number of firms that comprised the isolated nodes in the network has decreased from around 28 percent in 2003 to 16 percent in 2007 to almost 11 percent in 2012. The composition of these nodes suggests that firms belonging to the Top 50 business groups in India comprise of less than 10 percent of the isolated nodes and the numbers of business group firms are also always less than 35 percent of the firms which are isolated from the giant component in all the years. This unbalanced representation of group and standalone

firms among the isolated nodes indicates that ownership structure like group affiliation itself can be an important factor of inclusion of a firm within the giant component of the network. Panel B of Table 1 presents the summary statistics of firms based on their inclusion and exclusion from the giant component. Simple t-tests suggest that isolated firms are significantly smaller in size (as given by logarithm of total assets) and have lower total income than members of giant component. The mean age of isolated nodes is 23 years as opposed to 32 years for firms in the giant component. The differences in mean in ages turn out to be significant. The board size also varies significantly among the firms that are isolated and those included in the giant component.

Even though the firms belonging to the giant component are larger in size, have higher income, are older and have bigger boards, their accounting performance given by return on assets does not appear to be significantly different from the isolated firms in the sample. However, the variance in performance is statistically greater than that of firms belonging to the giant component. The preliminary descriptive analysis of the data suggests that further exploration is desirable.

3. Empirical Findings

We use a logit specification to model the probability of being isolated from the interlock driven inter-firm network in India.

Table 2: Effect of Business Group Affiliation on Probability of Being Isolated- Logit Model

The table reports the parameter estimates obtained from the logistic regression of probability of being an isolated node within the network on group dummy. The dependent variable is a dummy variable 'isolated node' which takes the value one if the firm is not a member of the giant component and zero otherwise. The independent variables are a set of firm characteristic variables, industry dummies and year dummies. Significance at 1 percent level is denoted by ****, **, * respectively against the parameter estimate values.

Variable	Column 1	Column 2
Group	-0.744***	-0.617***
	(0.116)	(0.124)
Age		-0.013***
		(0.004)
ROA		-0.276
		(0.524)
Firm size		-0.538***
		(0.040)
Board size		-0.012
		(0.015)
Constant	-1.276***	4.990***
	(0.069)	(0.656)
Industry dummies	No	Yes
Time dummies	No	Yes
Number of observations	3,817	3,795
Pseudo R-squared	0.020	0.174

Column 1 of Table 2 represent the result from the logistic regression of probability of being isolated on group dummy. The coefficient is negative and significant. Column 2 gives the regression results of the probability of being isolated only on group dummy after including firm

specific factors which may also affect the probability of isolation. The coefficient of group dummy is negative and significant and the average treatment effect is -0.062. The results suggest that group firm's probability of constituting the isolated nodes is less than that of standalone firms by 0.06 on average. The larger firms are less likely to be isolated. It can be indicative of fact that the large firms are more efficient and so are their directors and they are sought after in the directorial labor market. The age of the firm has a negative relation suggesting that older firms having survived in the corporate sector for a longer period can have an established reputation and it in turn can be connected to several other firms. The coefficient of board size and return on assets of is not significant.

To address endogeneity concerns we consider two approaches which is propensity score matching and instrument variable estimation. First, we consider the possibility that group firms and standalone firms may be characteristically different. We use propensity score matching technique to match group and standalone firms on observable characteristics like size, age, profitability and industry of operation. The matching reduces the sample size to 2,851 firm year observations. Table 3 gives that the group firms are less likely to constitute an isolated node in the network vis-à-vis a matched standalone firm. The difference in average treatment effect between matched group and standalone firms is -0.063.

Table 3: Average Treatment Effect for Matched and Unmatched firms

Sample	Treated	Controls	Difference	Standard error
Unmatched	0.117	0.217	-0.099***	0.012
Average treatment effect	0.117	0.180	-0.063***	0.017

Next we use the matched sample of firm year observation for our logit regression and the results are given in column 1 of Table 4. We find that the coefficient of group dummy is negative and significant indicating that probability of being isolated for a group firm is less than that of standalone firms. The average marginal effect is -0.059 suggesting a group firm is 0.06 times less likely to constitute isolated node than a matched standalone firm on average. The marginal effects are similar to the full sample results.

Secondly, to ensure that the group dummy is not capturing an important omitted variable in the system, we consider instrument variable. We use number of related party transactions as an instrument for group dummy. Intuition behind the selection of instrument is that group firms are likely to engage in more number of related party transactions, however, related party transactions are not directly related to a firm's inclusion within the director interlock driven network. Column 2 of Table 4 reports IV estimation results. The coefficient of group dummy continues to be negative and significant. The first stage equation satisfies the rank condition and also Cragg-Donald F-statistic rejects the null of weak instrument. The F-statistic is 17.49 greater than Stock-Yogo (2005) critical values.

The result supports Khanna and Rivkin's (2001) study which finds that group firms are more likely to enter into director interlocks. Also, it shows that a firm being isolated from the giant component of the network may not be a random event or coincidental. The ownership structure of the firm appears to have some explanatory power in predicting the probability of being isolated from the giant component of inter-firm network in the Indian context.

Table4: Effect of Group Firms on Probability of Being Isolated: PSM and IV Results

The table reports the parameter estimates obtained from the logistic regression of probability of being an isolated node within the network on group dummy. The dependent variable is a dummy variable 'isolated node' which takes the value one if the firm is not a member of the giant component and zero otherwise. Column 1 gives the effect of group affiliation on probability of being an isolated node for the subset of matched firms. Column 2 gives the effect of group affiliation on probability of being an isolated after using number of related party transactions as an instrument for group dummy. The values in parenthesis give the standard errors clustered at the firm level. Significance at 1 percent, 5 percent and 10 percent levels are denoted by ****, **, * respectively against the parameter estimate values.

	Column 1 Matched firms	Column 2 Instrument variable estimation
Group	-0.624***	-0.529***
	(0.138)	(0.197)
Age	-0.013***	-0.001**
	(0.004)	(0.000)
ROA	-0.852	-0.003
	(0.656)	(0.079)
Firm size	-0.538***	-0.039***
	(0.047)	(0.007)
Board size	0.006	-0.001
	(0.018)	(0.002)
Industry dummies	Yes	Yes
Time dummies	Yes	Yes
Constant	5.030***	1.024***
	(0.629)	(0.131)
Observations	2,843	3,317

4. Concluding Remarks

The study is a preliminary attempt to understand whether being isolated from the giant component of the network is related to firm characteristics. It finds that ownership structure like business group affiliation lowers the probability of a firm constituting an isolated node in India. In other words, after controlling other factors we find that standalone firms are more likely to constitute isolated nodes within the network. The results are robust to the considering a sample of matched group and standalone firms during the period. Also, using numbed of related party transactions during the year as an instrument for group affiliation, we find that group firms have lower probability of constituting an isolated node. The finding suggests that being excluded from the giant component of interlock driven network in India is in not a purely random outcome and appears to be influenced by organizational factors like business group affiliation. The standalone firms in India are more probable to be left alone in the interlock driven network and have to (with)stand-alone with access to a smaller pool of resources.

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