THE INCIDENCE AND PERFORMANCE EFFECTS OF INTERLOCKING DIRECTORATES IN EMERGING MARKET BUSINESS GROUPS: EVIDENCE FROM INDIA

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ABSTRACT

The phenomenon of interlocking directorates is widespread among corporate across the world. This paper studies the structure and extent of interlocking directorates within Indian business groups and analyses the performance effects of such interlocks. It finds that large groups tend to have more interlocks and more heterogeneous the group is, lesser are the interlocks. Finance and trading companies are seen to have a higher intensity of interlocks and holding companies occupy important nodes in the directorial network. The paper also shows that directorial interlocks improve the performance of group-affiliated firms.

Keywords: Interlocking directorates, board structure, corporate governance.

JEL Classification: G39, G34, C21, M2

1. INTRODUCTION

The phenomenon of interlocking of corporate directorates is common in developed as well as developing countries. Such interlocking is a situation where the same person occupies positions on the boards of more than one company. This phenomenon has historically received considerable attention in economics as well as in sociology. Different issues related to interlocks such as its effect on CEO-board relationships (Gulati and Westphal, 1999), its role in determining the effective independence of outside directors (Carpenter and Westphal, 1999), its effect on the formation of collusions and determining strategic behaviour (Gulati *et*

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al. 2000), and its role in information sharing and corporate acquisitions (Haumschild and Beckman, 1998), have been studied. Given that all these aspects related to interlocking have important implications for the structure and effective functioning of company boards, which in turn have an important role to play in corporate governance and company performance (Hermalin and Weisbach, 2000), the issue of interlocking assumes significant importance.

The objective of this paper is to look at the incidence of interlocking directorates in Indian business groups and to examine the effects of such interlocking on the performance of group affiliated companies. To my knowledge, this would be the first systematic study of interlocking directorates in Indian business groups and among the very few studies that exist with respect to developing and emerging economies [Lincoln *et al.* (1992), Keister (1998), Khanna and Rivkin (2000)]. Additionally, an important contribution of this study is that unlike earlier studies that have examined the effect of just the incidence of interlocks on company performance, my study goes a step further and estimates the relationship between performance and *magnitude* of interlock intensity. In the process, I have developed several measures of the magnitude of directorial interlocks for groups and companies.

The phenomenon of interlocking directorates is particularly relevant for business groups. Business groups are sets of companies that are most often under common ownership and management but in most cases, retain separate legal identities of their own. Under such a set up, there exist dense networks of all kinds of intercorporate ties among affiliated firms belonging to the same business group [for examples, see Granovetter (1995), Khanna and Palepu (2000) and Kali (1999)]. One such source of ties is in the form of interlocking directorates. With business groups being historically a dominant form of organization in India and interlocking being an inherent characteristic of such groups (See Mehta, 1955), these become natural candidates for the analysis of interlocking directorates.

A review of the existing theoretical and empirical literature on interlocking directorates reveals that there is a range of views with regard to the extent to which interlocking matters in

company performance. Following Koening, *et al.* (1979), one can identify four specific models, all of which outline how interlocking impacts on the performance of companies. On one extreme, the *management control model* downplays the role of board interlocks and other board structures and emphasises that managers take the most important decisions and as such, are unaffected by the opinions of the board. The *reciprocity model* works when two or more firms cooperate on a matter of mutual interest with Interlocking of directorates being one of the ways in which this reciprocity is brought about. The proponents of the *finance control model* postulate that contrary to the Berle and Means (1932) paradigm of the independent firm that relies more on its own capacity to grow and evolve, firms depend on a dense network of intercorporate ties, especially with financial institutions as they are the principal providers of finance. Finally, the *class hegemony model* proposes that interlocking directorates are more a means of ensuring inter-organisational elite co-opitation and co-operation (Patrick, 1974) than anything else and are thereby, "socially embedded" (Granovetter, 1985). Along with these models, the other two primary motives for interlocking documented in the literature are the *information exchange motive* and the *control motive*. The former refers to the sharing of important information relating to new policies, trade secrets and practices among firms that are parties to the interlock, that could lead to better performance (see, for example, Haumschild and Beckman, 1998). The control motive, on the other hand, points to the existence of interlocks as a controlling device.

The majority of the research on interlocking directorates has been with respect to developed countries like US, Japan, Germany, Belgium. The studies for the US have pointed to a *city-based* network of interlocking. [Koening, *et. al*. (1979), Allen (1974)], being partially consistent with the class hegemony model. Some other studies have found a decline of interlocking over time (Dooley, 1969), although Allen (1974) in support of the finance control model, finds an increase in the extent of financial interlocks maintained by non-financial firms. In the case of Japan, Lincoln, *et. al*.(1992) obtain a positive relation between interlocks and firm performance for Japanese *Keiretsus*.

The work done on interlocking for developing and emerging economies has mainly been in the context of business groups. For companies belonging to Chinese groups, Keister (1998) shows a positive relationship between interlocks and firm performance and finds that information sharing was the prime mover behind directorial interlocks. Khanna and Rivkin's (2000) study on Chile has shown that if two companies have interlocking directorates, then the likelihood of them belonging to the same business group is larger.

Although India is an emerging economy and despite the predominance of large business houses in its corporate sector, not much rigorous and systematic work exists as of now that studies the extent and incidence of directorial interlocks in Indian business groups and its possible impact on company performance. The only exception in this regard is a study in the fifties (Mehta, 1955), which examined interlocking at the time when managing agency system was prevalent and there was a dearth of managerial talent. Over the years, notwithstanding important institutional and economic changes, the importance of ties among group-affiliated firms such as directorial interlocks have continued to persist and retain its relevance (for example, see Khanna and Palepu 1999). Also, with the onset of globalisation in recent years, as corporate reform initiatives have gained momentum, the role of the board of directors and the issue of directorial interlocks have started receiving renewed attention [see for example, the Kumar Mangalam Birla Committee Report (Birla, 2000) and the CII Report on Corporate Governance (CII, 1998)]. It is in this context that the present study becomes particularly relevant.

The rest of the paper is structured as follows. The next section lays out the data and methodology. In the third section, I portray the nature and extent of directorial interlocks in Indian business groups. The fourth section presents the estimation results showing the performance effects of interlocks and discusses the results. The fifth section concludes. All the tables and figures referred to in this paper are collected in the appendix.

2.DATA AND METHODOLOGY

My primary data source is the Prowess Database produced and maintained by the Centre for Monitoring Indian Economy Private Limited and it contains firm level information on various characteristics such as financial and performance variables, information relating to ownership groups, constitution of boards of directors, industry classifications, etc. The period for which the data has been taken is 1999-2000. The sample chosen for my analysis consists of companies belonging to the Top 50 business houses. Data on boards of directors as well as other firm level information was compiled as they stood at the end of March 2000.

In generating the dataset on directorial interlocks, a list was first prepared for the companies belonging to each of the Top 50 business houses, which totalled 895 companies. Some business houses that had undergone splits or had functional subgroupings but listed in Prowess as intact were also taken care of by listing the subgroups as separate groups, thereby obtaining 89 business groups. In many of the cases, the initials of the directors were given in Prowess instead of the full names. In these cases, the full names were obtained by making personal telephonic calls to the company head offices and from the company websites.

After generating the data on director names and company affiliations, I took the names of all these companies group-wise and counted the number of times each name occurred inside each of the groups. Using this data, I calculate three measures of directorial interlocks, namely (i) *Group_interlock*, (ii) *Co_interlock*, (iii) *Normal_interlock*.

These measures are calculated in the following manner. Let a business group G_i have $n(G_i)$ companies in it denoted by $j = 1,2\ldots n(G_i)$. Let the j*th* company $(j \hat{I} G_i)$ have D_j directorial positions in it. Let the number of directors occupying positions on the boards of all the companies be P. *Group_interlock* is then calculated as:

$$(Group\_\text{int}erlock)_i = \frac{P}{\sum_{j=1}^{n(G_i)} D_j} \qquad (1)$$

Co_interlock or the company-wise measure of interlocks is calculated in the following manner. Let the persons occupying directorial positions on the board of the *jth* company be denoted by M^j_k *(k = 1,2…Dj)*. Let us assume that the k^{th} person also occupies positions on the boards of N_k *other* group companies (one position in one company). Then, *Co_interlock* is given by:

$$(co\_interlock)_j = \sum_{k=1}^{D_j} N_k \qquad (2)$$

From these two measures, I derive the following proposition:

Proposition: *The probability of a company j* [$j \in G_i$, *j=1,2…n(Gi)*] *belonging to a business group Gi, being interlocked with other companies in the group* ($k \in G_i$, *k =1,2…n(Gi); k ¹ j*) *is weakly increasing in the size of its board of directors when the group size remains fixed and it is weakly increasing in the group size when the board size remains fixed.*[1]

From the proposition, it becomes evident that *Co-interlock* depends on board size and group size. To correct for this dependence, I normalise this measure by the board size and group size. This normalised measure *Normal_interlock* is calculated as follows:

$$(Normal\_interlock)_j = \frac{(Co\_interlock)_j}{D_j[n(G_i)-1]} \qquad (3)$$

Theoretically, $0 < (Group\_interlock)_i \leq 1$. The extent of directorial interlocks within the group G_i declines as the magnitude of $(Group\_interlock)_i$ increases. The second measure satisfies the condition $0 \leq (Co\_interlock)_j \leq Dj[n(G_i) - 1]$ and its value increases as the number of directorial interlocks of company *j* rises. It should be noted that the measure *Normal_interlock* measures the intensity of interlocks, lies between 0 and 1 and increases as

[1] See Appendix for proof.

the intensity of interlocks rises. The final measure is the one that I use in the regression analysis[2].

3. INCIDENCE OF DIRECTORIAL INTERLOCKS

This section examines in detail the incidence of directorial interlocks and brings out some basic features exhibited by interlocking directorates in Indian business groups. Tables 2 and 3 and Figures 1 and 2 summarise the basic findings with respect to company interlocks, board size and group size and group interlocks, group size and group diversification. The weighted averages in the tables are computed by using the number of companies in the groups as a proportion of the total number of companies in the size class as weights. Several interesting facts are evident from the tables. The magnitude of the *Co_interlock* measure increases as the board size and group size rise. This is demonstrated by an increase in the *Co_interlock* variable as one moves down Table 2 towards higher size classes. These two findings are in line with the proposition of Section 2.

Table 3 points to some other interesting facts. It shows that the extent of interlocks within groups increases as the group size rises. This is demonstrated by the fact that as one moves towards higher size classes, the value of the *Group_interlock* variable declines. It should be noted that in the way the variable *Group_interlock* is defined, a decline in the value of *Group_interlock* implies an increase in the extent of interlocks. The other interesting result from this table concerns the relationship between group heterogeneity and group interlock. For each of the business groups in my sample, the heterogeneity is computed by dividing the number of distinct two digit-industry classifications (by Prowess) by the group size and I call this measure as G_Het. It is obvious that this value lies between zero and one and heterogeneity of the group increases with an increase in the value of the number. It can be

[2] In graph theoretic terms, the measure *Co_interlock* is the sum of the *In-degree* and *Out-degree* of each of the nodes of the graph that has the companies as the nodes and the interlock ties as the links. Each business group is conceived as a graph in this framework. However, in this paper, the direction of the ties could not be ascertained (i.e., the *In-degree* and *Out-degree* could not be separated out because

seen from Table 3 that as the heterogeneity of the group rises, the value of the variable *Group_interlock* increases, indicating a decline in the extent of interlocks within the group. This is an interesting finding in the sense that it points to the existence of "related industry interlocks", with possible synergy effects from specialisation, thereby activating the information-sharing motive

To analyse whether interlocks are more in companies having a particular line of business, I classified companies as finance companies, trading companies and others. I then ranked companies within each business group according to the values of *Normal_interlock* in a descending order and looked at the activities of the first three companies in the ranking for each of the groups. The results are shown in Table 4.

It is evident from the table that the number of business groups in which at least one finance company figured among the top 3 is the highest. The number of business groups in which at least one trading company figured among the first three companies is also quite large. Interestingly, in all except for 6 business houses, all the finance and trading companies among the first three companies belonging to each business group had boards of directors that were relatively small. In fact, but for these 6 cases, all the finance and trading companies have board sizes that are smaller than the mean board sizes for the groups. Thus, the high values of *Co_interlock* for these companies is more a result of higher interlocks that the board members maintain with other group companies than a result of large board size. This is an indication of interlocks being used primarily for control purposes because finance companies are in charge of financing the group companies and the more important persons (persons occupying positions on a large number of boards) sit on the boards of these companies. Many a times, the finance companies are also the holding companies of the respective groups and hence important members sit on their boards, so that they can retain control of the other group companies through the provision of finances.

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the decomposition of the board into inside and outside directors or executive and non-executive was not available for most companies in the sample.

The possible reason that trading companies feature high in the list is that in many cases, they were also among the oldest companies in the group. By virtue of being among the oldest as well as the holding companies of the groups in some cases, the more important persons including the family members and promoters occupied positions in their boards.

An analysis was also carried out to study the relationship between the age of the business house and the value of the *Group_interlock* variable for the group (Table 5). For this I have taken the age of the oldest company of the group as a proxy to measure the age of the business group. It was expected that older groups would be having greater extent of interlocks because of the strong foothold that they had created for themselves and since family control was expected to be more predominant for older groups. The results do not, however, support this. The table as also the scatter plot in Figure 3 show that there is no systematic pattern between the age of the group and the value of *Group_interlock*. Thus, interlock ties seem to be ubiquitous in business groups, old or new.

Another interesting feature of business groups in India as well as abroad is the presence of a holding company. A holding company is one that owns more than 50% of the stocks of the other group companies. It is through these holding companies that the promoters in most of the cases exercise control over the other group companies. It is expected that in most of the cases, the more important family members and close associates of the family members will be sitting on the boards of the holding companies. Thus, it is also expected that the holding companies in any group would be interlocked with other group companies via directorial ties. For exposition purposes, I have considered the interlocking pattern of the holding company of the Tata Group, Tata Sons Ltd. and the picture is presented in Figure 4.

Figure 4 shows the interlock structure of the holding company of the Tata Group, Tata Sons Ltd. with eighteen directors on its board, with other group companies. In the figure, each of the lines connecting Tata Sons Ltd. to the other group companies depicts one common director between the two companies. The other common directorships between the other

companies are not shown in the figure in order to prevent the figure from getting cluttered. The pattern that emerges follows the expected lines. We find a dense network of interlocks. However, this seems to be the pattern for older groups and larger groups because the entrenchment motive is likely to be stronger for them than for smaller and newer groups.

4. PERFORMANCE EFFECTS OF DIRECTORIAL INTERLOCKS

This section presents an econometric estimation of the performance effects of interlocks with respect to the sample of group-affiliated companies chosen for this study.

4.1 The Model and Variables

For the estimation, I conduct the analysis by regressing company performance on a variable measuring the extent of interlocks, controlling for other factors that may influence performance. As stated in Section 2, I use the normalised measure of interlock, *Normal_interlock* (denoted by N_LOCK) as my variable of interest to measure the magnitude and intensity of company-wise directorial interlocks. The measure of performance that has been used in the analysis is the Return On Assets (ROA) for the year ending March 2000.

The standard way in which performance has been measured in the literature on interlocks is productivity per worker. However, I take ROA as a measure of company performance as has been used in some other studies [Khanna and Palepu (1999)]. ROA is defined as (Profits before interest and taxes net of non recurrent expenditures/Total Assets) and calculated with Profits before tax and interest because in India, the tax treatment is not uniform across companies and non-recurrent expenditure has been deducted from it because the accounting procedures followed are also non uniform. Market based measures such as Tobin's Q and Market to Book Value Ratio have not been used because these figures are available only for listed companies. Since business groups contain a large number of unlisted companies as well, usage of these measures would have meant a drastic reduction in the number of observations and hence, would have given rise to problems of interpretation, more so because

many of the unlisted companies within the groups consist of trading and finance companies that have a high degree of directorial interlocks.

Given that several other company characteristics can also affect performance, I consider a host of control variables in the estimation. The control variables used are log of sales (LSALES), age of the company (AGE), export intensity (EXPINT), depreciation intensity (DEPINT), R&D intensity (RDINT), advertising intensity (ADVINT), leverage (LEVG), proportion of loans from other group companies (LO_GR), heterogeneity of the group to which the company belongs (G_HET), industry dummies (IND1…IND20), a dummy to indicate if the company is diversified or not (DIV) and a dummy to indicate a finance company (FINANCE). A dummy variable is taken to indicate listed companies (LIST), and to control for the fact that many listed companies are not frequently traded and hence may not be subject to external market pressures in a significant way, I have taken the relative number of days on which the stocks of the companies had traded on the Bombay Stock Exchange and interacted with the LIST dummy to obtain a measure of effective listing (EFFLIST). The descriptions of the control variables are in the appendix.

It is likely that the companies that belong to a business group would be having some common elements, many of which would be unobserved. Ordinary Least Squares with a classical error structure cannot be used to capture this effect. In fact, as Moulton (1986) has pointed out, using OLS when group specific effects are present would result in low standard errors of the estimates, giving rise to the rejection of the null hypothesis, which would point to the presence of a significant relationship when no such relationship actually exists. Because of the presence of some variables that remain invariant across all firms in a group, a fixed effects model could not be used. So, I have used a random effects model. For the i^{th} company in the j^{th} group, the model is given as:

$$(ROA)_{ij} = \beta_0 + \beta_1 (N\_LOCK)_{ij} + X'\delta + v_{ij} \qquad (4)$$

The error structure of the model is the following.

$$
\begin{aligned}
&v_{ij} = u_{ij} + e_j \text{ with } u_j \sim N(0, \sigma_u^2),\ e_j \sim N(0, \sigma_e^2);\\
&\text{Cov}(u_{ij}, u_{kl}) = \sigma_u^2, \text{ if } i = k \text{ and } j = l. \text{ and 0 otherwise;}\\
&\text{Cov}(e_j, e_l) = \sigma_e^2, \text{ if } j = l \text{ and 0, otherwise;}\\
&\text{Cov}(u_{ij}, X_p) = \text{Cov}(e_j, X_p) = \text{Cov}(u_{ij}, e_j) = 0\ \forall\ p, i \text{ and } j.
\end{aligned}
\qquad \text{(A.1)}
$$

Here, $(ROA)_{ij}$ is the Return On Assets of the i^{th} company in the j^{th} business group as it stood at the end of March, 2000 and $(N\_LOCK)_{ij}$ is the normalised measure of interlock of the i^{th} firm in the j^{th} group; X is a matrix of observations on the control variables and β_0, β_1 and δ are the coefficients to be estimated. The error term v_{ij} incorporates the fact that companies within a group are correlated but the correlation across groups is zero. Observations on all the relevant variables could be obtained for 608 firms on which the regression was based.

4.2 Results and Discussion

The summary statistics are presented in Table 6 and the results are summarised in the first panel of Table 7. The first observation is that the coefficient of N_LOCK, 0.092 is significant at the 10% level and positive and thus, it implies a positive and significant effect of interlocks on performance. The more intensely the directors of a company are interlocked with other group companies, the better the company is seen to be performing in terms of the ROA. Hence, my results point to the fact that the negative effects of interlocks in terms of entrenchment and crony capitalism, if at all they exist, are outweighed by the gains from information sharing and better governance, giving rise to a positive net effect. This result is in line with earlier results obtained by Keister (1998) and Lincoln, *et. al.*(1992) for Chinese and Japanese business groups respectively.

With respect to the signs of the coefficients of the control variables, several interesting results are evident from the regression. We see that LIST has a negative and insignificant coefficient and so does EFFLIST, which shows that widely held, listed companies that are subjected to

the market forces are not, after all, doing a better job of governance and that closely held group-affiliated companies seem to be faring better.

Among the other variables, LSALES has a highly positive and significant effect on performance, showing that larger firms generally perform better than smaller ones. G_HET, on the other hand, is seen to have a negative and significant effect on firm performance, showing that firms belonging to less diverse groups perform better than those belonging to the more diversified ones. This also supports the present endeavour of many Indian groups to shed many of their non-core businesses and move onto a more focused strategy.

Among the industry dummies, FINANCE is seen to be highly positively significant. Among the other industries, IND2 has a negative and significant effect on the ROA, indicating that companies belonging to agro-based industries performed worse than others and so did companies belonging to the textile industry (indicated by the negative and significant coefficient of IND6); IND16 has a positive and significant coefficient, indicating a higher ROA for companies in the electronics industry.

In the analysis undertaken so far, it has been borne out that the intensity of directorial interlocks has a positive and significant effect on firm performance. But, one also needs to consider the other two effects of interlocks that may be having a negative effect on firm performance. These two are the *decreasing returns to scale effect* and the *entrenchment effect*. The first effect is activated when a director holds positions in "more companies than he can handle", thereby affecting performance adversely. The other effect works when the interlocking is a result of placing family members and friends on the boards of directors of multiple companies without any consideration whatsoever for the efficiencies and capabilities of the concerned people, giving rise to "crony capitalism". This does not have the desired positive effects on company performance. Taking into account these two effects, it was expected that till a certain value of the interlock intensity, performance of companies would increase with increases in the intensity of interlocks, beyond which the negative effects would

start outweighing the positive ones, bringing about a decline in firm performance with successive increases in the intensity of directorial interlocks.

In order to test for the presence of these effects in the context of Indian business groups, I incorporated a quadratic term for N_LOCK in the random effects model given by equation (4) along with N_LOCK to examine the presence of any turning points in the interlock intensity – performance relationship. The regression results for the other variables were the same as they had been in the earlier regression but, the coefficients of N_LOCK and $(N\_LOCK)^2$ turned out to be insignificant, thereby negating the existence of turning points in the relationship. The relationship, in fact, had a turning point in the N_LOCK < 0 range and as such, was not relevant for my study because in my analysis, $0 \leq N\_LOCK \leq 1$. I had also tried to determine the turning points endogenously by employing a spline regression technique. I carried out the analysis using two spline variables created on N_LOCK. The results, once again, pointed out the insignificance of the spline variables, thereby ruling out the existence of turning points for our sample. Thus, we find that in the present context, the positive effects of directorial interlocks outweigh the negative ones, giving rise to a positive relationship for our sample of companies.

Till now, the analysis had been carried out under the assumption that in the random effects model, the companies belonging to the same group would be having some commonality which would be captured by the error variance- covariance structure shown in (A.1). Under this structure, however, the underlying assumption was that the non-zero covariances between the errors of firms belonging to a group would remain the same for all the groups. This, however, may not be a valid assumption. Because it is but natural to think that different groups would be having different degrees of cohesion among the companies in the group and as such, the covariances are likely to be different. That makes it necessary to fit a Random Effects Model with *groupwise heteroscedasticity* in this context. The model for the i^{th} company in the j^{th} group will be:

$$(ROA)_{ij} = \beta_0 + \beta_1 (N\_LOCK)_{ij} + X'\delta + v_{ij} \qquad (5)$$

The error structure of the model is the following.

$$\begin{aligned}
&v_{ij} = u_{ij} + e_j \text{ with } u_j \sim N(0, \sigma_u^2),\ e_j \sim N(0, \sigma_{ej}^2);\\
&Cov\,(u_{ij}, u_{kl}) = \sigma_u^2, \text{ if } i = k \text{ and } j = l. \text{ and 0 otherwise;}\\
&Cov\,(e_j, e_l) = \sigma_{ej}^2, \text{ if } j = l \text{ and 0, otherwise;}\\
&Cov\,(u_{ij}, X_p) = Cov\,(e_j, X_p) = Cov\,(u_{ij}, e_j) = 0\ \forall\ p, i \text{ and } j.
\end{aligned} \qquad (A.2)$$

Here, again, $(ROA)_{ij}$ is the Return On Assets of the i^{th} company in the j^{th} business group as it stood at the end of March, 2000 and $(N\_LOCK)_{ij}$ is the normalized measure of interlock of the i^{th} firm in the j^{th} group; X is a matrix of observations on the control variables and β_0, β_1 and δ are the coefficients to be estimated. The error term v_{ij} incorporates the fact that companies within a group are correlated but the correlation across groups is zero. However, in this case, $Cov\,(e_j, e_l) = \sigma_{ej}^2$, if j = l and 0, otherwise (and not σ_e^2 as was the case in equation 4). The model thus incorporates the presence of groupwise heteroscedasticity. Although the specification suggested by Moulton (1986) had been used in the context of business groups by Khanna and Palepu (1999), they did not use a model incorporating groupwise heteroscedasticity, which needs to be incorporated in order to analyse business groups.

The results of the model with groupwise heteroscedasticity are shown in the second panel of Table 7. The first thing to be noticed in this table is that the coefficient of N_LOCK in this model has increased to 0.1047 and the value of the t-ratio has increased from 1.685 in the model without heteroscedasticity to 1.7, indicating an increase in the significance of the coefficient. This shows that when different group-specific effects are incorporated in the model, interlock intensity explains performance better than in the earlier case. This maybe because of the fact that the extent to which interlock intensity affects company performance depends also on the differences in the other group characteristics, which are captured in the random effects model with groupwise heteroscedasticity.

The conclusions regarding the signs and significance of the other variables more or less remain the same in this model. The first major observation is that the variable EFFLIST becomes negatively significant at the 10% level in this case. It had a negative effect earlier but was not significant in explaining company performance. The other interesting result is that the variable G_HET loses its significance in the present model, probably because a part of the heterogeneity of the groups (in terms of the industry classifications of the companies belonging to the groups) has already been incorporated in the model via the error structure given by (A.2). The other variable to lose significance is EXPINT, although it retains its sign. Among the industry dummies, IND2 and IND16 lose their significance but retain the signs. On the other hand, IND5 (denoting the food/beverage/tobacco industry) becomes negatively significant at the 10% level, IND7 (denoting the leather industry) becomes positively significant at the 10% level and IND12 (denoting non-metallic mineral products) becomes negatively significant at the 10% level.

To summarise, we see that directorial interlocks do have a positive effect on firm performance in Indian business groups for both the models. The exact channel of the improved performance cannot, however, be assessed from the analysis. It can be due to better information sharing between the group affiliated companies and better governance exercised by the system of interlocking directorates. The analysis of the exact channel can form possible areas of extension of this study.

5. CONCLUSION

It has been shown that the extent of interlocking within 89 Indian business groups is quite substantial. Larger groups had more interlocking than smaller ones and more heterogonous groups had less of interlocking, pointing to the existence of related industry interlocks. The relative importance of finance companies and trading companies in the intragroup directorial network is also noticed.

The primary results do not seem to find support for the *management control model* that had been described at the beginning of the paper. The raw data had shown that in many of the family business groups, most of the positions on the boards are occupied either by family members or other relatives and friends. This is more so in case of the holding companies and finance companies of the groups and those are the companies that dictate the activities of many of the other group companies and also provide them with finance. Generally speaking, the era of the management deciding on most important matters has not yet arrived for many of the family business groups and board structure and board members still have a significant role to play.

The paper, however, finds partial support both for the *reciprocity model* as well as the *finance control model*. Within many of the groups, board members are seen to occupy positions on boards on a reciprocal basis. The most interesting manifestation of this phenomenon occurs in the case of family groups that have split during inter-generational transfers or otherwise and as such, have fragmented into independent subgroups. In these cases, it may be interesting to note that many board members continue to occupy reciprocal positions across the subgroups even after the split. This maybe a pointer to some kind of a tacit understanding between the subgroups. Also, the fact that in many of the cases, the group companies have a significant level of interlocks with the finance companies and holding companies of the groups indicates the existence of some variation of the *finance control model.*

The raw data also points to the existence of some variation of the *class hegemony model* in some of the family business groups. Although the city-based or region-based nature of interlocks have not been analysed, it has been noticed that in some of the older family groups, many of the directorial interlocks among the group companies have been caused by members belonging to the same traditional castes as the promoters or belong to the same region as the promoters' family. This particular phenomenon has its roots in the origin of the trading communities in India and their conversion into the entrepreneurial class and as such, is more of a historical or sociological phenomenon.

The paper finds that both the *information exchange* and the *control motive* are operational in case of directorial interlocks in Indian business groups. The existence of a large number of interlocks of group companies with the holding companies of the groups in many cases suggests the importance of holding companies in the directorial network. The holding companies generally have the promoters and family members occupying important positions on the boards and high level of interlocks they have with other group companies suggests the existence of the *control motive* behind the existence of these interlocks. On the other hand, the existence of *related industry interlocks* signifies the existence of the *information exchange motive* as the driving force behind these interlocks. The relative magnitudes of these two motives however, remain unexamined in this paper.

The paper has also shown that the intensity of interlocks affects company performance positively, which is in confirmation with the studies of interlocking and performance for countries like China and Japan. The interesting feature of this particular effect is that interlocks affect performance positively in a uniform manner; the advantages gained from interlocks are seen to offset the negative impact of them at any stage, thereby suggesting that these informal "ties that bind business groups" do have a role to play even now in case of Indian business groups.

The current work can be extended in several directions. It has not considered the direction of the network ties due to inadequate data. One can differentiate the interlocks as those between family members and those created by professional members and analyse the relative importance of these two types of interlocks. How interlocks fare *vis-à-vis* other types of inter-firm ties such as cross holding of shares can be another interesting line of analysis. Performance may also affect interlocks, which may induce endogeneity into the mode. These are the areas in which I am working at present.

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APPENDIX

Description of the Control Variables

LEVG is defined as the ratio of long-term debt to total equity and reserves. This variable captures the effect of corporate tax shields.

LSALES refers to the logarithm of sales. This variable reflects the unobserved factors that are related to the size of the company.

EXPINT refers to the export intensity of firms. It captures the effect of exposure to international competition.

ADVINT refers to the advertisement intensity of the firm. It is measured as the ratio of advertisement expenditure to total sales. It captures the effect of intangible assets.

DEPINT is the depreciation intensity of the firm. It is measured by the ratio of depreciation expenditure to total sales. It is a proxy for the capital intensity of the firm. More the value of DEPINT, higher the capital intensity of the company.

RDINT is the research and development intensity, being measured as the ratio of total R&D expenditure to total sales. It is incorporated to capture the effects of R&D on performance.

LO_GR is the proportion of loans obtained by the company from other group companies. This is incorporated to measure the extent of inter-firm ties within a group.

G_HET is a measure of group diversity, being defined as the ratio of the number of distinct two-digit classification within the group to the number of firms in the group. Higher values of the variable indicate greater diversity.

INDi is an industry dummy for the ith industry. It takes a value of 1 for companies belonging to the ith industry and 0 otherwise.

FINANCE is a dummy that takes the value of 1 if the company in question is a finance company and 0 otherwise. This has been taken to capture the special nature of finance companies.

DIV is a dummy that takes the value of 1 if the company is a diversified and 0 otherwise. A diversified company imperfectly distributes the product-specific risk on performance.

LIST is a dummy taking the value of 1 for listed companies and zero otherwise.

EFFLIST is the interaction term between LIST and the relative number of trading days.

TABLE 1: PERCENTAGE OF ASSETS HELD BY THE TOP 50 INDIAN BUSINESS GROUP AMONG ALL INDIAN BUSINESS GROUPS OVER THE YEARS

	1991-92	**1992-93**	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**
Top 50 Indian Business Groups	69.96	69.19	65.67	64.52	65.01	65.83	67.07
Other Indian Business Groups	30.04	30.81	34.33	35.48	34.99	34.17	32.93

Data Source: Economic Intelligence Service. Corporate Sector. May 1999. CMIE. P.

TABLE 2: COMPANY INTERLOCKS, GROUP SIZE AND BOARD SIZE

Number of Companies in the Business Group	Number of Business Groups	Average Board Size				Average *Co_interlock*			
		Average	Weighted Average	Maximum	Minimum	Average	Weighted Average	Maximum	Minimum
1 – 5	27	7.802	7.750	13.000	4.000	2.531	3.202	8.000	0.000
6 - 10	31	7.854	7.794	11.833	5.000	7.628	7.712	16.286	6.000
11 - 20	22	7.846	7.863	9.882	5.692	10.514	10.525	18.778	2.917
21 - 50	6	6.645	6.730	8.071	5.077	11.269	11.971	20.357	5.364
> 50	1	8.754	8.754	8.754	8.754	16.492	16.492	16.492	16.492

TABLE 3; GROUP DIVERSIFICATION AND GROUP INTERLOCKS

Number of Companies in the Business Group	Number of Business Groups	Group Heterogeneity (At the Two-digit Level of Industry Classification)				Average *Group_interlock*			
		Average	Weighted Average	Maximum	Minimum	Average	Weighted Average	Maximum	Minimum
1 – 5	27	0.769	0.738	1.000	0.333	0.877	0.845	1.000	0.667
6 – 10	31	0.521	0.511	1.000	0.167	0.743	0.740	0.846	0.511
11 – 20	22	0.419	0.423	0.615	0.091	0.708	0.711	0.862	0.573
21 – 50	6	0.350	0.322	0.636	0.167	0.684	0.676	0.806	0.621
> 50	1	0.230	0.230	0.230	0.230	0.648	0.648	0.648	0.648

TABLE 4: THE MAIN LINES OF ACTIVITIES OF COMPANIES HAVING THE HIGHEST INTENSITY OF INTERLOCKING WITHIN EACH BUSINESS HOUSE*

Number of Business Groups having at least one finance company among the first three companies ranked by "intensity of interlocking"	Number of Business Groups having at least one trading company among the first three companies ranked by "intensity of interlocking"	Number of business groups having neither a finance company nor a trading company among the first three companies ranked according to "intensity of interlocking"
42	18	28

*The entries indicate the number of business houses., having the specified characteristic. The data has been obtained using the disaggregated data set that treats the split business houses and the functional subgroupings within business houses as separate groups. Finance companies and trading companies are those that have the following as their main line of activity:

Finance Companies	Trading Companies
Investment services	Trade in textiles
Financial and leasing services	Trade in manufactured goods
Equipment leasing services	Trade in electrical machinery
Hire purchase finance services	Trade in beverages and tobacco
Hire purchase and leasing services	Trade in non electrical machinery

TABLE 5: AGE OF THE BUSINESS GROUP AND EXTENT OF DIRECTORIAL INTERLOCKS

Age of the Oldest Company of the Business Group (in years)	Number of Business Groups	Group_Interlock			Group Size		
		Average	Maximum	Minimum	Average	Maximum	Minimum
0 – 25	12	0.793	1.000	0.511	5.333	11	1
26 – 50	19	0.782	1.000	0.531	7.368	18	1
51 – 75	21	0.745	1.000	0.573	11.476	42	2
76 – 100	21	0.786	1.000	0.621	10.522	26	1
101 – 125	8	0.767	1.000	0.648	20.625	61	2
126 – 150	4	0.697	0.761	0.642	10.750	17	6

TABLE 6: DESCRIPTIVE STATISTICS OF THE VARIABLES

Variable	Mean	Standard Deviation	Minimum	Maximum
ROA	0.0755	0.1337	-0.6860	0.8192
N_LOCK	0.1139	0.1041	0.0000	0.6250
AGE	31.0510	24.3634	1.0000	137.0000
EXPINT	0.0954	0.1924	0.0000	1.0000
ADVINT	0.0078	0.0252	0.0000	0.2968
LEVG	1.6322	14.1230	-46.2634	329.2381
DEPINT	0.1306	0.9122	0.0000	20.0000
RDINT	0.0020	0.0064	0.0000	0.1000
LIST	0.5789	0.4941	0.0000	1.0000
EFFLIST	45.8838	44.6653	0.0000	100.0000
LSALES	4.1438	2.2320	-4.6052	9.9184
G_HET	0.4384	0.1827	0.0909	1.0000
LO_GR	0.0665	0.2086	0.0000	1.0000

TABLE 7: RESULTS OF THE REGRESSION ANALYSIS

	Regression without groupwise heteroscedasticity (Equation 4)			*Regression with groupwise heteroscedasticity (Equation 5)*		
Variables	**Coefficient**	**t-values**		**Coefficient**	**t-values**	
N_LOCK	0.0920	1.685	***	0.1047	1.700	***
AGE	-0.0008	-2.950	*	-0.0008	-3.377	*
EXPINT	0.0510	1.873	***	0.0414	1.573	
ADVINT	0.2100	1.014		0.2019	0.980	
LEVG	-0.0002	-0.837		-0.0002	-0.766	
LSALES	0.0290	9.198	*	0.0350	10.972	*
DEPINT	-0.0040	-0.621		-0.0027	-0.458	
RDINT	-0.8780	-1.049		-0.5682	-0.691	
LIST	-0.0280	-1.292		-0.0261	-1.192	
EFFLIST	-0.0003	-1.317		-0.0004	-1.701	***
LO_GR	-0.0270	-1.006		-0.0074	-0.275	
G_HET	-0.0790	-2.380	**	-0.0699	-1.509	
IND2	0.0710	2.166	**	0.0482	1.448	
IND3	-0.0009	-0.006		0.0057	0.102	
IND4	-0.0600	-1.055		-0.0456	-0.756	
IND5	-0.0390	-1.005		-0.0678	-1.731	***
IND6	-0.0560	-2.314	**	-0.0589	-2.249	**
IND7	0.1870	1.548		0.2121	1.801	***
IND8	0.0620	0.509		0.0548	0.463	
IND9	0.0030	0.074		-0.0083	-0.194	
IND10	0.0160	0.698		0.0115	0.490	
IND11	0.0190	0.697		0.0139	0.472	
IND12	-0.0460	-1.479		-0.0555	-1.773	***
IND13	-0.0220	-0.903		-0.0168	-0.667	
IND14	0.0120	0.498		0.0157	0.637	
IND15	-0.0140	-0.544		-0.0134	-0.503	
IND16	0.0490	1.901	***	0.0310	1.179	
IND17	0.0310	1.272		0.0145	0.583	
IND18	0.0140	0.237		0.0346	0.590	
IND19	0.0240	0.565		0.0038	0.089	
IND20	-0.0310	-0.624		-0.0596	-0.956	
FINANCE	0.0600	2.218	*	0.0678	3.185	*
DIV	-0.0230	-0.754		-0.0285	-0.924	
Constant	0.0200	0.829		-0.0176	-0.609	
R-Squared		0.236			0.246	

Significance Levels: *1%, **5%, ***10%

FIGURE 1:SCATTER PLOT OF GROUP_INTERLOCK AND GROUP SIZE

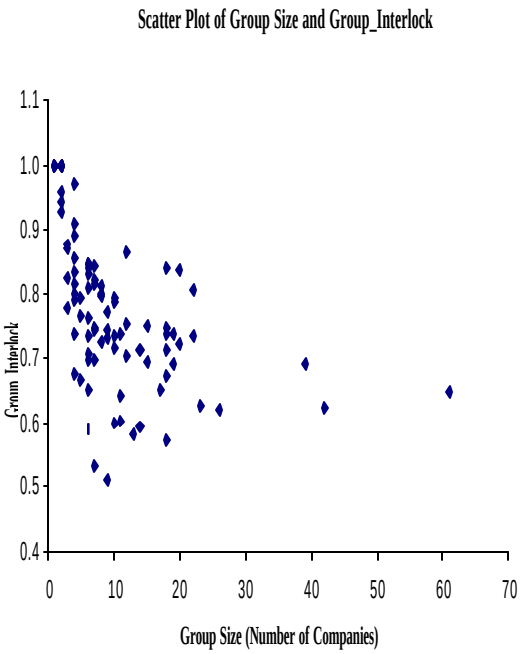


FIGURE 2: SCATTER PLOT OF GROUP_INTERLOCK AND GROUP HETEROGENEITY

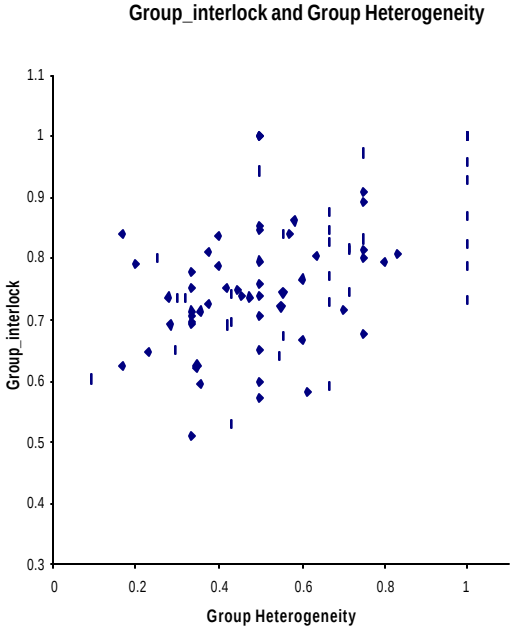


FIGURE 3: SCATTER PLOT OF GROUP_INTERLOCK AND AGE OF THE GROUP (AS MEASURED BY THE AGE OF THE OLDEST COMPANY OF THE GROUP)

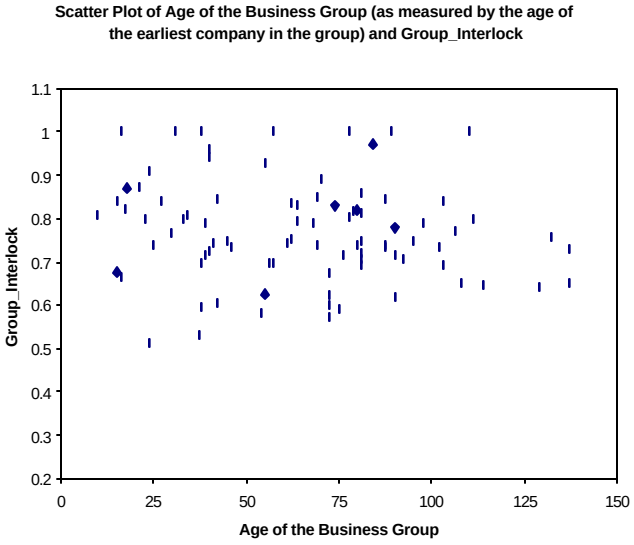
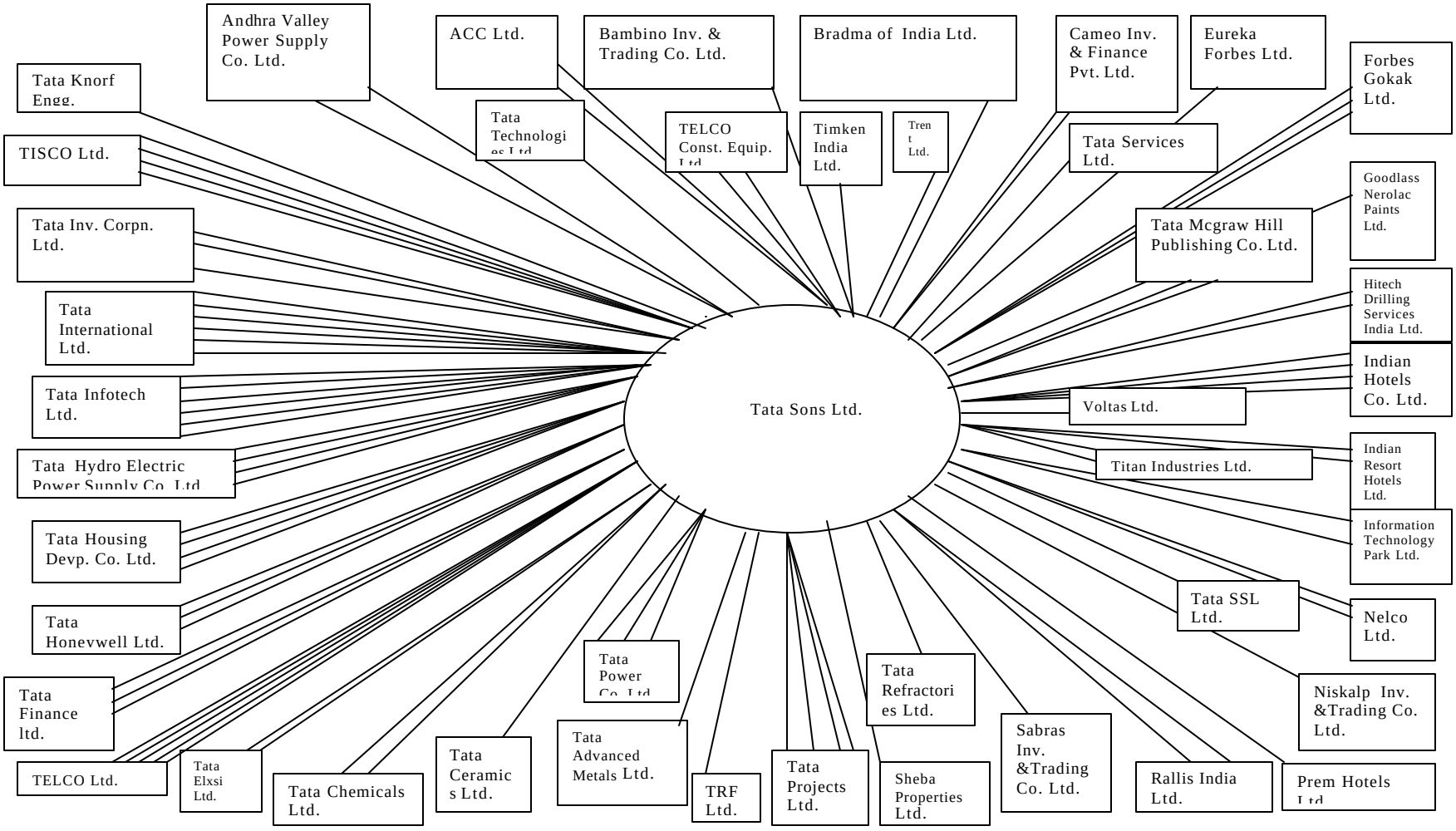


FIGURE 4: INTERLOCKING DIRECTORATES BETWEEN THE HOLDING COMPANY OF THE TATA GROUP (TATA SONS LTD.) AND THE OTHER COMPANIES OF THE GROUP



Proof of Proposition

Proposition: *The probability of a company j [j Î G_i, j=1,2…n(G_i)] belonging to a business group G_i being interlocked with other companies in the group (k Î G_i, k =1,2…n(G_i); k ¹ j) is weakly increasing in the size of its board of directors when the group size remains fixed and it is weakly increasing in the group size when the board size remains fixed.*

Proof: Let a business group be defined as the set of the companies belonging to it and let us call this set as *G*. From now onwards, the group will be referred to as *G*. Let the number of companies belonging to the group be *N* so that $n(G) = N$.

Let a typical company belonging to the group *G* be denoted by *i* ($i \in G, i = 1,2…N$). Let each of the companies belonging to the group have a board of directors. Let the set of persons occupying the board of directors of the i^{th} company be B_i and let the number of members on the board of directors of the i^{th} company be denoted by M_i so that $n(B_i) = M_i$. Let a typical member on the board of directors of the i^{th} company be denoted by i_k ($k = 1,2…M_i$). Let the event that the k^{th} member of the i^{th} board also sits on the board of another company *j* ($j \in G, j = 1,2…N, j \neq i$) be denoted by $E_{ik,j}$ ($i,j \in G$ *and* $i \neq j$). The event that the k^{th} member of the i^{th} board sits only on the i^{th} board and nowhere else will be denoted by $E_{ik,0}$. Then, the event that the k^{th} member of the i^{th} board sits on the board of *at least another* company *j* ($j \in G, j \neq i$) will be denoted by $\bar{E}_{ik,0}$.

After laying down the basic framework, there are certain assumptions that I have made. These can be listed down as follows:

i. The events $E_{ik,j}$ and $E_{pr,q}$ are independent of each other $\forall\, i \in (1,2…N), p \in (1,2…N), k \in (1,2…M_i), r \in (1,2…M_p), (j \in G$ *but,* $j \neq i)$ and $(q \in G$ *but* $q \neq p)$. Also, it is not the case that $i = p, k = r$ *and* $j = q$ simultaneously.

ii. The events $\overline{E}_{ik,0}$ and $\overline{E}_{pr,0}$ are independent of each other $\forall\, i \in (1,2\ldots N)$, $p \in (1,2\ldots N)$, $k \in (1,2\ldots M_i)$, $r \in (1,2\ldots M_p)$. Also, it is not the case that $i = p$, $k = r$ simultaneously.

iii. The probability of the event $E_{ik,j}$, $P(E_{ik,j}) = q \;\forall\, i \in (1,2\ldots N)$, $k \in (1,2\ldots M_i)$, and $j \in G$ *but,* $j \neq i$.

iv. The probability of the event $\overline{E}_{ik,0}$, $P(E_{ik,0}) = p_N \;\forall\, i \in (1,2\ldots N)$, $k \in (1,2\ldots M_i)$ when the number of companies in the group G is N.

We start by keeping the number of companies in the group G (the size of the group) fixed at N and allow the board size of each company to vary. Then, given assumptions i-iv, it is clear that when the board size of a company i ($i = 1,2\ldots N$) is equal to M_i, the company i will be interlocked when at least one member of the board of i also sits on the board of at least another company j ($j \in G$ *but,* $j \neq i$). Denoting the probability that company i will be interlocked when its board size is M_i by $P(M_i)$, we have

$P(M_i) =$ *P(the company i is interlocked)*

or, $P(Mi) = P$ (*Co_interlock > 0*)

or, $P(M_i) = P$ [*At least one member of the board of i sits on the board of at least another company j*], ($i,j \in G$ *but,* $i \neq j$)

$$or, P(M_i) = P\left(\bigcup_{k=1}^{M_i} \overline{E_{ik,0}}\right) \tag{A.1}$$

$$= \sum_{k=1}^{M_i} P(E_{ik,j}) + \sum_{k=1}^{M_i}\sum_{l=1}^{M_i} P(E_{ik,j} \bigcap E_{il,j}) - \sum_{k=1}^{M_i}\sum_{l=1}^{M_i}\sum_{m=1}^{M_i} P(E_{ik,j} \bigcap E_{il,j} \bigcap E_{im,j}) + \ldots + (-1)^{M_i - 1} P\left(\bigcap_{k=1}^{M_i} E_{ik,j}\right)$$

$$k<l \qquad\qquad k<l<m$$

$$= M_i p_N - {}^{M_i}C_2\, p_N^{\,2} + {}^{M_i}C_3\, p_N^{\,3} - \ldots + (-1)^{M_i - 1} p_N^{\,M_i} \tag{A.2}$$

If now, the size of the board is increases from M_i to $(M_i + 1)$, then the probability that the company has an interlock is (by a similar logic as the one used in the derivation of Equation (A.2)

$$P(M_i + 1) = (M_i + 1)\, p_N - {}^{M_i+1}C_2\, p_N^{\,2} + {}^{M_i+1}C_3\, p_N^{\,3} - \ldots + (-1)^{M_i}\, p_N^{\,M_i+1} \tag{A.3}$$

Subtracting equation (A.2) from equation (A.3):

$$P(M_i+1)-P(M_i)=p_N-M_i p_N{}^2+\frac{M_i(M_i-1)}{2!}p_N{}^3-\frac{M_i(M_i-1)(M_i-2)}{3!}p_N{}^4+....+(-1)^{M_i}p^{M_i+1}$$

$$=p_N[1-M_i p_N+\frac{M_i(M_i-1)}{2!}p_N{}^2-\frac{M_i(M_i-1)(M_i-2)}{3!}p_N{}^3+....+(-1)^{M_i}p_N{}^{M_i}]$$

$$=p_N(1-p_N)^{M_i} \qquad \text{(A.4)}$$

From Equation (A.4), it is clear that $P(M_i+1) - P(M_i) \geq 0$ and it will be strictly greater than zero when $p_N >> 0$ for any company i ($i \hat{I} G$, $i=1,2\ldots N$). Thus, the probability that company i is interlocked is weakly increasing in company i's board size when the number of companies in the group remains fixed.

Now, if we allow the group size to vary but keep the board size of the i^{th} company fixed at M_i ($i = 1,2\ldots N$), then

$$P(\overline{E_{ik,0}})=$$

$$\sum_{j\neq i}^{N}P(E_{ik,j})-\sum_{\substack{j<s\\ j\neq i,\,s\neq i}}^{N}\sum^{N}P(E_{ik,j}\bigcap E_{ik,s})+\sum_{\substack{j<s<t\\ j\neq i,s\neq i,t\neq i}}^{N}\sum^{N}\sum^{N}P(E_{ik,j}\bigcap E_{ik,s}\bigcap E_{ik,t})-....+(-1)^{N-1}P(\bigcap_{i=1}^{N}E_{ik,j}) \qquad \text{(A.5)}$$

$$P(\overline{E_{ik,0}})=(N-1)q-{}^{N-1}C_2 q^2+{}^{N-1}C_3 q^3-....+(-1)^{N-2}q^{N-1}$$

$$=1-[1-(N-1)q+{}^{N-1}C_2 q^2-{}^{N-1}C_3 q^3+....+(-1)^{N-3}q^{N-1}]$$

$$=1-(-1)^{-2}[1-(N-1)q+{}^{N-1}C_2 q^2-{}^{N-1}C_3 q^3+....+(-1)^{N-1}q^{N-1}]$$

$$=1-(1-q)^{N-1}$$

Thus,

$$p_N=1-(1-q)^{N-1} \qquad \text{(A.6)}$$

Now, if the group size is increased from N to (N+1), then

$$p_{N+1}=1-(1-q)^{N} \qquad \text{(A.7)}$$

Now, from equations (A.6) and (A.7):

$$p_{N+1} - p_N = q(1-q)^{N-1} \geq 0 \qquad \text{(A.8)}$$

From equation (A.8), it can be seen that as the size of the business group increases, the probability that a member of the board of directors of company *i* occupies a position on at least another company *j* (*j* Î *G*, *j*¹ *i*) also increases. Since the company is interlocked if at least one of the members on its board of directors of the company sits on the board of at least another company, then as the probability that a board member of the company sits on at least another board increases, the probability that the company is interlocked also increases. Thus, as group size increases, the probability that a company belonging to the group is interlocked also increases. This can be seen more clearly if we differentiate both sides of equation (A.2) with respect to p_N.

$$\frac{\partial P(M_i)}{\partial p_N} = M_i[1-(M_i-1)p_N + \frac{(M_i-1)(M_i-2)}{2!}p_N^{\,2} - \ldots + (-1)^{M_i-1}p_N^{\,M_i-1}]$$

$$= M_i(1-p_N)^{M_i-1} \geq 0 \qquad \text{(A.9)}$$

From equation (A.9), it is clear that when the probability that a board member sits on at least another board increases, the probability that the company being studied is interlocked also increases. But, from equation (A.8), it can be seen that the probability that a board member sits on at least another board increases with group size. Hence, combining equations (A.8) and (A.9), we conclude that the probability that a company *i* (*i = 1,2…N*) is interlocked with other companies in the group *G* weakly increases with the size of the group *G* when the board size of each company remains fixed.