Linguistic homophily in director networks and firm performance

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Abstract

The presence of homophily in social ties is a reality. It is simply the tendency of people with similar characteristics to form more ties among them. The paper revisits the director network and firm performance relation for listed firms in India after accounting for the presence of homophily among directors based on their linguistic backgrounds. The study finds that director network and firm performance is positively related in accordance to the resource dependence hypothesis, however considering homophily strengthens this positive association. In presence of homophily, the director network provides access to resources and the firm also benefits from better coordination in boards. The linguistically weighted director network is more important for firms involved in research activities. Also, standalone firms are more dependent upon director network for gaining access to resources vis-à-vis their group counterparts. However, the advantages on account of better coordination among board members accrue both to group and standalone firms. Further the study highlights the economic importance of having linguistically diverse boards. It appears that having directors from same linguistic background may foster better coordination leading to smooth functioning of the board, but when majority of the directors belong to a particular linguistic community then the lack of availability of diverse perspectives sets in and has a moderating effect on director network and firm performance relation.

Keywords: Network, homophily, board diversity, firm performance

JEL Codes: G32, G34, L21, M14, Z13

1. Introduction

The role of board of directors as providers of resources to the firm is well established. The resource dependence theory of boards suggests that directors help organizations to manage external uncertainty and provide access to external information and other resources (Pfeffer, 1972). The network of individual directors can largely determine the resources which the firm can access through its directors. Many studies have found that director network is related to firm outcomes like performance (Larcker, 2011), CEO turnover and CEO compensation (Barnea and Guedj, 2009; Hwang and Kim, 2009), governance structure (Bouwman, 2011), etc.

The director network is formed by way of repeated interaction among the directors in the network on account of sharing of board seats. The underlying assumption is that all interactions are positive in nature and each director interacts with other fellow directors with equal intensity. However, in real world the extent and nature of communication among all fellow directors in the network is not equal. The demographic features of the directors like age, gender, cultural background, etc. can determine the communication pattern among the directors and this in turn can affect individual director network. Allowing for differential rate of interaction among directors with varied demographic characteristics can help to understand whether demographic composition of the director network is important in affecting firm outcomes.

Few studies have tried to study the effect of demographic features like gender, age and ethnicity of directors on firm level outcomes (Carter et al., 2003; Campbell and Minguez-Vera, 2008; Adams and Ferreira, 2009; Carter et al., 2010). However, I am unaware of any study which has explicitly incorporated the cultural diversity of the directors within the network in determining the strength of directorial ties and test its relation with firm performance. Further, mostly studies on director networks and firm performance are in the context of developed economies. The developed countries have a mature corporate governance regulatory environment along with developed market for corporate control and dispersed ownership structure. On the other hand in many emerging markets the corporate governance regime is still evolving and firms are mostly characterised by concentrated ownership structure. These economies are dominated by business groups which are a set of legally independent entities that are connected through a network of

ties like transfer of goods, training of labour, provision of capital through intercompany loans and guarantees and sharing of directors. Researchers argue that business groups are a natural outcome of the lack of well developed institutions and product and labor markets in the emerging economies. The paper intends to fill this gap in the literature by accounting for culture in determining the strength of directorial ties in the network and revisit the director network and firm performance relation in the context of an emerging market economy.

India classifies as an ideal candidate for the study for following reasons. Firstly, India is among one of the most culturally diverse nations. Workplaces bring people from different cultural backgrounds together and corporate boards are no different. Boards more often than not comprise of directors from various cultural backgrounds and demographic variation in form of cultural diversity is easily observable. Secondly, Indian corporate sector has been historically dominated by large business groups. Mehta (1955) points out that on account of limited availability of funds and entrepreneurial ability in the pre-independence era, firms owned by few wealthy families entered the corporate market. The concentration of ownership was by way of both horizontal and vertical expansion by firms managed by family based entrepreneurs. The groups so formed often did set up a managing agency firm which promoted the group firms and ensured managerial efficiency while restoring the legal and functional independence of the affiliates. By 1950s, only ten domestic Managing Agency firms like Tata, Birla, Dalmia and others in India controlled more than 200 firms. The institutional environment and globalization of business fostered the growth of business groups and in 2006 around 88 percent of firm assets were owned by group firms in India (Sarkar, 2010). Thirdly, as per Clause 49 of the Listing Agreement firms are required to provide information of directors sitting on their boards. Availability of such reliable data enables researchers to dwell into inter-corporate networks of directors in the Indian corporate sector with satisfactory level of accuracy.

In this paper I consider the differences in extent of communication due to cultural diversity of directors and analyze whether including demographic feature of the director network has any effect on existing director network and firm performance relation. Oetzel (2009) states that *"Cultural diversity can be indexed by national culture, ethnicity, language, gender, job position, age or disability"*. In India, directors come from different states and have distinct mother tongue.

Post independence, language has been a prime factor in determining state boundaries. Hence, I choose linguistic affiliation of the directors to classify them as culturally similar or diverse. As the actual nature of directorial interaction is not known, I use the homophily principle to assess strength of directorial ties within the network. The concept of homophily in sociology literature suggests that people with similar characteristics tend to form more non-negative ties with similar people. For example, women are more likely to mix with other women, children of same age are more likely to become friends, marriages are more likely among people from the same community, etc. McPherson et al. (2001) in their review of homophily literature emphasize that racial and ethnic homophily are among the most important forms of homophily and exists in all kinds of relations like marriages, friendship, work relations, etc. This indicates that race and ethnicities continue to be an important social boundary in modern day world. Many studies have highlighted the presence of ethnic homophily under different social settings (Ibarra, 1995; Bertrand et al., 2000; Mollica et al., 2003; Kao and Joyner, 2004; Freeman and Huang, 2014).

Related to the literature of homophily; there exists a vast literature on diversity which essentially studies how differences in personal traits can affect relations. The literature on diversity and its effect on group outcomes have produced mixed results. One strand of researchers argues that group diversity foster creativity which in turn improves group output. Robinson and Dechant (1997) discuss five reasons that make diversity in workplace as desirable. Firstly, diversity improves creativity of the team by presenting different perspective of culturally different people. Secondly, diverse workers may have initial coordination issues however discussions on conflicting ideas improve their problem solving ability. Thirdly, diversity in workforce makes corporate leadership more effective as homogenous group can often present a narrow view on issues of concern. Fourthly, diversity can help in understanding the needs of diverse customer base. Finally, ethno-cultural diversity can be help firms to succeed in cross cultural markets. Others argue that higher diversity leads to less integration among the group members which can negatively affect their functioning. O'Reilly et al. (1989) in their study of effect of diversity of groups find that homogeneity of work groups are associated with higher group level integration and lower turnover.

The paper revisits the director network (henceforth 'conventional director network') and firm performance relation for listed firms in India by considering linguistic homophily in directorial ties i.e. allowing for higher rate of non-negative communication among board members having similar linguistic affiliation. It also analyzes how board diversity affects the director network and firm performance relation.

Using a sample of 3357 firm year observations of NSE listed firms in India; the study finds that conventional director network and firm performance is positively related as proposed by resource dependence theorists. However, considering linguistic homophily in directorial ties; strengthens the existing conventional director network and firm performance relation. Allowing for more interaction among linguistically similar directors facilitates better coordination helping the board to reach a consensus faster on conflicting issues. In addition to advantages from conventional director network, the firm benefits from smooth functioning of the board in linguistically weighted director networks. It seems that by ignoring the presence of linguistic homophily the importance of director network gets underestimated. Further, I find that linguistically weighted director network is more important for firms involved in research and development activities as coordinated boards can take lesser time in approving research proposals.

I also find that ownership structure like affiliation to business group affects the director network and firm performance relation. Standalone firms depend on director's network for access to resources as a mean to establish reputation. On the other hand group firms have established reputation and can access resources available to other firms within the group and this lessens the importance of director network. However, on considering linguistic homophily the positive association is strengthened both for standalone as well as group firms. This indicates that benefits of coordination among the directors belonging to the same linguistic community accrue both to standalone and group firms.

The study also focuses on boards that are dominated by directors from a particular linguistic community. I find that board diversity has a strengthening effect on director network and firm performance relation. When boards are dominated by directors of the same linguistic community there can be a lack of availability of diverse perspectives and this is harmful for board efficiency.

The director network still continues to be positively related for firms with less diverse board albeit the relation is weaker. The finding also reiterates the fact that board diversity is desirable not only from ethical perspectives but for economic reasons.

The contribution of this paper to the existing literature is fourfold. Firstly, it adds to the general corporate governance literature by testing the director network and firm performance relation in the context of an emerging market economy. Secondly, the study contributes to board literature by assessing whether demographic characteristic of directors like linguistic affiliation can influence the director network and firm performance relation. Thirdly, it also adds to the board literature and highlights the importance of board diversity for economic reasons. Finally, it contributes to the growing literature of economic networks and provides evidence on how strength of relational ties and economic outcomes are related.

The remaining paper is organized as follows. Section 2 develops the testable hypotheses. Section 3 provides a description of data and discusses the construction of the network. Section 4 presents the methodology followed and Section 5 gives the empirical results. Finally, Section 6 presents the summary and conclusions of the study.

2. Hypothesis development

The resource dependence view suggests that the primary function of the board is to provide resources to the firm. As discussed earlier, directors can place the firm in beneficial position by bringing legitimacy, providing advice and counsel, linking the firm to outside environment and ensuring support/ commitment from external agents through their contacts (Pfeffer and Salancik, 1978). In other words directors who are more central in the network of directors are expected to provide greater access to resources which in turn can improve firm performance. So, the larger size of the director network of the firm; which is simply the average of the connectedness of all the directors of the firm, is expected to improve performance of the firm. Henceforth, I refer to this unweighted director network as the '*conventional director network*'.

The principle of homophily suggests that people with similar traits tend to form higher number of non-negative ties with similar people. In India people belonging to different states speak different language and have varied socio-cultural backgrounds. It is expected that directors of same state interact with each other more frequently given common language, common beliefs and rituals. Bertrand et al. (2000) in their analysis of presence of influence effect in networks consider common language as the basis of formation of network ties. Increased interaction among directors having similar linguistic backgrounds can have two opposing effects. Firstly, directors from similar background can feel more connected to each other on account of shared cultural history and experiences resulting in higher cooperation among them. This can lead to effective communication among the board members ensuring smooth functioning of the board which in turn improves firm performance. If this be the case then accounting for higher interaction among the directors with similar linguistic attributes will strengthen the positive relation between the conventional director network and firm performance. I called the director network taking into account the homophily based on common language as *'linguistically weighted director network'* (LWDN). On the other hand, it is likely that people from different backgrounds provide varied perspectives which can lead to better problem solving ability. More interaction among the directors having varied linguistic backgrounds will foster inter-mixing of different viewpoints which in turn can produce noble ideas which is beneficial for firm performance. This indicates that higher the interaction among the directors with similar linguistic attributes can have a moderating effect on the conventional director network and firm performance relation. This is to say that linguistically weighted director network will have a smaller effect vis-à-vis director network. I test which of these effects is valid in the context of Indian firms during the period:

Hypothesis1: Linguistically weighted director network has either a strengthening or a moderating effect on the conventional director network and firm performance relation.

The Indian corporate landscape consists of both standalone and business group firms. The standalone firms are likely to rely on director network for access to information which may not be readily available in the market. The director network is a vital source of information and

means of accessing resources for standalone firms. Also, director network helps standalone firms to establish reputation in the market place.

On the other hand business groups in India have been prevalent for long and have established reputation. As a result their reliance on director network for legitimacy purpose is significantly lower. Also, the resources available to one group firm are often made available to the entire group lowering their dependency on directors for provisioning of resources. Further, business group firms are often ultimately owned by wealthy families and the few of the directors are members of the promoter family. If entrenchment hypothesis is true, then it is possible that board level decisions are driven by the personal interests of the insider controller and the advice and counsel provided by the directors are less important in influencing strategic board decisions and in turn firm value. Finally, business group firms can be able to mobilize support or preferential treatment from outsiders given the social standing of the wealthy promoter families. Hence, I hypothesize:

Hypothesis2: The relation between linguistically weighted director network and firm performance is stronger for standalone firms in the network vis-à-vis group firms.

Even though diversity of boards is desirable from ethical and social perspective, there is no regulation in India that mandates firms to have a diverse board[2]. In reality, often boards are dominated by people form a particular community. The economic advantages of having a diverse board have at best produced mixed results (Carter et al., 2003; Adams and Ferreira, 2009; Carter et al., 2010). Having directors from varied linguistic backgrounds having different cultural experience can provide alternate perspectives enriching the board level decision making process which can be especially beneficial for firm performance at times of external crisis or uncertainty. However, if majority of the directors belong to the same linguistic community then board is likely to have access to less diverse perspectives and the minority directors may not be in a strong position to ensure that other directors agrees to his/her problem solving mechanisms. Lack of cultural diversity in board composition is then likely to weaken the linguistically weighted

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[2] The New Companies Act 2013 requires certain firms to appoint at least one women director on their board. However, there was no mandate on diversity of boards as per the Companies Act 1956.

director network and firm performance relation. On the contrary, it is possible that more linguistically diverse boards find it difficult to coordinate and cooperate making it difficult to reach a consensus. In turn if the more than half of board is composed of directors of same linguistic community it eases the board coordination problem. In such cases having a culturally less diverse board can generate economic benefits for the firm by strengthening the linguistically weighted director network and firm performance relation. The net effect of having majority of directors from a particular linguistic group in presence of homophilous nature of directorial ties is an empirical question. Thus, I test the following in the Indian context:

Hypothesis 3: Boards which are dominated by directors of a particular linguistic community affects existing linguistically weighted director network and firm performance relation.

3. Data
3.1 Sample

The analysis is based on data provided by the Prowess database maintained by the Centre for Monitoring Indian Economy (CMIE). Prowess is a database containing detailed information on large and medium Indian firms from their respective annual reports. It contains activity codes of firms, equity ownership pattern, financial data as well as the names of the directors of the firms. The sample consists of all the firms listed on the National Stock Exchange (NSE) of India in 2012 for which information on their board of directors was available. I consider only listed firms as the Clause 49 of the Listing Agreement is applicable only to these entities. Other unlisted firms are not mandated to publicly disclose details pertaining to their board of directors. As board level information is pivotal to this analysis, I only focus on NSE listed firms.

In an attempt to understand the director network at different stages of evolution of the corporate governance practices followed by Indian firms, I chose three distinct times point i.e. 2012, 2007 and 2003. The year 2012 corresponds to the most recent year for which data is available. Further, I selected 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 Clause 49 of the Listing Agreement in January 2006 respectively. Hence, I collected data for financial years 2003, 2007 and 2012 for the firms listed on the NSE in 2012.

The final sample is obtained after excluding firms for which financial information is not available or details on shareholding pattern is missing. Firm year observations with extreme values are also eliminated from the analysis. Post the screening I arrived at an unbalanced panel comprising of 3357 firm year observations.

3.2 Variables
3.2.1 Director network variable

For constructing the network variable I had to first create unique director identification number ('UDID') for each of the director within the sample. The UDIDs are simple numerical identification number. Once the UDIDs are created, I applied the network methodology to construct the director network variable. The first step was to construct an incidence matrix for each of the years under analysis where the directors (cases) are the rows and the firms (affiliations) are the columns of the matrix. If a particular director 'i' serves on the board of firm 'j' then the element $a_{i,j}$ takes the value 1 and zero otherwise. I arrive at year-wise adjacency matrix from these incidence matrices which are square matrices. The rows and columns are directors in the network and each element in the matrix tells whether there is a connection among the directors on account of sitting on the same board. From the adjacency matrices I compute the standard year-wise undirected network centrality measures which gives the individual director's network score. Computation of these measures entails the application of graph theory. The nodes of the graph represent the directors (cases) in the network and the edges connecting them indicate whether they are connected by way of occupying board seats in the same firm. The centrality measures identify the key influential actors in the network. I compute the firm level director network by dividing the sum of individual level director network score by the size of the board.

The conventional director network measures used for the purpose of this study are given below[3].

Degree centrality

A director who is connected to maximum number of other directors in the network is considered to be the most active node. It is a simple count measure given by the number of ties formed by each director. If there is an edge from a director i to another director j, then the element a_{ij} is 1 otherwise 0. Higher number of direct ties indicates that the director has larger access to information pool and there is possibility of greater exchange as well as influence. Hence, degree centrality is given as:

$$\sum_{j=1}^{n} a_{ij}$$

From the example above it is evident that directors C, E and F have degree of 5 whereas director D has a degree of only 3.

Closeness centrality

Closeness centrality emphasizes the importance of distance of a director from others in the network. The closeness measure tells us how quickly a director in the network can reach any other director within the network. Here quickness is simply the number of intermediate persons that separates any two directors. It is measured as the inverse of the average distance between director i and director j:

$$\frac{1}{\sum_{i \neq j} l(i,j)}$$

where $l(i, j)$ is the number of links in the geodesic (shortest path) between i and j.

In the example, directors C, E and F have the highest closest centrality as they are directly connected to other directors in the network.

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[3] The conventional centrality measures are computed with the help of statnet package in R.

Betweenness centrality

Betweenness centrality views a director as being in a favored position to the extent that the director falls on the geodesic paths between other pairs of directors in the network. The higher the number of directors that are dependent on a particular director to make connections, higher is his centrality in the network. Betweenness centrality of director i is defined as the ratio of the number of shortest paths connecting j and k that pass through i and the overall number of shortest paths that connect j and k. Let $P_i(kj)$ denote the number of geodesics between j and k that i lies on, and let $P(kj)$ be the total number of geodesics between j and k. Then betweenness centrality is given by:

$$\sum_{k \neq j: i \notin (k,j)} \frac{P_i(kj)}{P(kj)}$$

In the above example, director D has the lowest betweenness centrality as directors A and B need not have to pass through D in order to reach others in the network.

I normalize the centrality measures using the following transformation:

$$Normlalized\ centrality\ measure = \frac{Centrality\ measure - Min}{Max - Min}$$

Since, the above is an affine transformation it does not change the significance of the original measure.

Linguistically weighted director network variable[4]

I compute linguistically weighted centrality measures to account for linguistic homophily in director networks. For simplicity, I assume that directors of same community interact with each other more given by weight of '2'. On the other hand inter-community interaction within the

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[4] The weighted centrality measures are computed with the help of tnet package (version 3.0.11) in R.

network is assumed to be lower and is assigned a weight of '1'. The centrality measures discussed above are re-computed after assigning weights to each of the ties.

3.2.2 Dependent and control variables

The dependent variable in the analysis is firm performance which can be measured either by accounting profitability measures or by market value measures. The primary advantage of using market value measures is that it is observable and it reflects the information that the market participants have and how they perceive the underlying firm. Several corporate finance studies have used Tobin's Q as a measure of market value of the firm. Conventionally, Q-ratio is defined the ratio of market value of assets and debt to the replacement cost of assets. However, in India a significant portion of the firm's debt is institutional debt which is not traded in the capital markets and assets are also recorded at their historical costs. Hence, I use an adjusted Tobin's Q-ratio as primary measure of firm performance which is defined as the sum of market value of equity and book value of debt divided by the book value of assets.

Since firm performance is expected to be influenced by various factors, I control for firm size, age, board size, leverage ratio, promoter's shareholding and affiliation to a business group in the regression analysis. In addition to these, I incorporate industry and time dummies in both the analyses in order to control for industry and time specific factors respectively.

4. Methodology[5]

The empirical specification for capturing the effect of linguistically weighted director network on firm performance, I estimate the equation below:

$$Adjusted\ Tobin's\ Q - ratio_{i,t} = \alpha + \emptyset_1 Linguistically\ weighted\ director\ network_{i,t} +$$
$$\beta_1 Age_{i,t} + \beta_2 Firm\ size_{i,t} + \beta_3 Group\ dummy + \beta_4 Board\ size_{i,t} + \beta_5 Promoter's\ share_{i,t} +$$
$$\beta_6 Leverage\ ratio_{i,t} + \sum_l \gamma_l\ Industry\ dummies + \sum_k \delta_k\ Year\ Dummies + \varepsilon_{i,t} \qquad .....1(a)$$

In order to assess the relation between conventional director network on firm performance, I estimate equation 1(b):

$$Adjusted\ Tobin's\ Q - ratio_{i,t} = \alpha + \emptyset_2 Director\ network_{i,t} + \beta_1 Age_{i,t} + \beta_2 Firm\ size_{i,t} +$$
$$\beta_3 Group\ dummy + \beta_4 Board\ size_{i,t} + \beta_5 Promoter's\ share_{i,t} + \beta_6 Leverage\ ratio_{i,t} +$$
$$\sum_l \gamma_l\ Industry\ dummies + \sum_k \delta_k\ Year\ Dummies + \varepsilon_{i,t} \qquad \qquad .....1(b)$$

Since, the various centrality measures convey different information I use each of them separately for all the regressions.

If $\phi_2 > \phi_1 > 0$, then it indicates that director network in general is beneficial for firm performance, however, more interaction among persons belonging to the same linguistic community leads to loss of access to diverse perspective and better problem solving ability which in turn is detrimental for firm performance. On the other hand if $\phi_1 > \phi_2 > 0$, then it suggests that conventional director network underestimates the extent of positive association between director network and firm performance by not accounting for the presence of linguistic homophily.

Now, to test the relation between weighted director network and firm performance when boards are dominated by directors of a particular linguistic community, I introduce a dummy interaction variable. I define a dummy variable 'Majority' which takes the value one if more than 50 percent of the board comprises of directors of a specific linguistic community and zero otherwise. The regression equation is the following:

$$Adjusted\ Tobin's\ Q - ratio_{i,t} = \alpha + \emptyset_3 Linguistically\ weighted\ director\ network_{i,t} +$$
$$\emptyset_4 Linguistically\ weighted\ director\ network_{i,t} * Majority + \beta_1 Age_{i,t} + \beta_2 Firm\ size_{i,t} +$$
$$\beta_3 Group\ dummy + \beta_4 Board\ size_{i,t} + \beta_5 Promoter's\ share_{i,t} + \beta_6 Leverage\ ratio_{i,t} +$$
$$\sum_l \gamma_l\ Industry\ dummies + \sum_k \delta_k\ Year\ Dummies + \varepsilon_{i,t} \qquad \qquad .....2(a)$$

$\phi_4 < 0$ indicates that boards comprising of directors of a particular community is detrimental for firm performance as it can lead to loss of access to diverse viewpoints. If the $\phi_{3 + } \phi_4 > 0$ then the

net effect of having majority of the directors from a single community is still positive, but is weaker than the case of having a more diverse board. If the $\phi_{3+}\phi_4 < 0$ then the boards dominated by directors of a community can in effect be negatively related to firm performance measures as having less diverse board can be value reducing. On the other hand $\phi_4 > 0$ suggests less diverse further enhances coordination among the directors and strengthens the existing positive relation between director network and firm performance.

To assess the effect of having more than fifty percent of directors from a particular linguistic religious for conventional director network measures, I estimate equation 2(b) below:

$$Adjusted\ Tobin's\ Q-ratio_{i,t} = \alpha + \emptyset_5 Director\ network_{i,t} + \emptyset_6 Director\ network_{i,t} *$$
$$Majority + \beta_1 Age_{i,t} + \beta_2 Firm\ size_{i,t} + \beta_3 Group\ dummy + \beta_4 Board\ size_{i,t} +$$
$$\beta_5 Promoter's\ share_{i,t} + \beta_6 Leverage\ ratio_{i,t} + \sum_l \gamma_l\ Industry\ dummies +$$
$$\sum_k \delta_k\ Year\ Dummies + \varepsilon_{i,t} \qquad\qquad\qquad .....2(b)$$

If $\phi_3 + \phi_4 > \phi_5 + \phi_6 > 0$, then the net effect for culturally less diverse boards can be said to stronger when directorial ties are measured after considering homophily in directorial ties. On the other hand if $0 < \phi_3 + \phi_4 < \phi_5 + \phi_6$, it indicates that in linguistically weighted director network the negative effect of having less diverse perspective is higher than conventional networks and as a result the net positive effect of is smaller in magnitude.

I refrain from using firm fixed effects approach, since the *director network* is a slow changing variable. The magnitude of director network of a firm is likely to change sluggishly over a period of time, however, in a given year the network is expected to vary substantially across firms. Adopting a fixed effects methodology can suppress the between firms variation and results may not indicate any relation between director network and firm performance, even if there exists a cross sectional relation (Zhou, 2001). Thus, in my specification, I control for the observable firm level characteristics and unobservable factors only at the industry level.

To ensure that the results are not influenced by the presence of extreme values, I carry out 90 percent winsorization of the data. This method set bottom 5 percent data to 5 percentile and top 5

percent data to 95 percentile. Further, the business group firms are likely to be connected through several ties like transfer of goods, training of labour, etc.; and many of these are unobservable from the point of view of reported data. In such a scenario the errors of these group firms can be correlated and the OLS result can overestimate the significance of the estimated variables. Hence, in the analysis, I allow the errors across firms within a specific business group to be related. The errors among standalone entities and between business groups are still assumed to be independent. This is similar to the Khanna and Palepu's (2000) methodology in the analysis of diversified business group firms in India. All the reported regression results are based on group-wise clustered errors.

5. Results
5.1 Descriptive results

Table 2 presents the descriptive statistics of firm level variables for the full sample of firms and also for group and standalone firms separately. Using simple t-tests, it is evident from the table that group firms have larger director network vis-à-vis the standalone firms based on the centrality measures. Also, the group firms are significantly larger in size (as given by logarithm of total assets) than the standalone firms. The mean age of group firms is 34 years as opposed to 27 years for standalone firms. The median board size of group firms is 9 and that of standalone firms is 8. However, the promoter's shareholding in group firms is significantly lower than standalone firms. It is likely that in group firms have a pyramid structure and the promoter's hold low cash flow rights even though they retain control rights in the firms. The business group firms are more leveraged than standalone firms and the differences in mean and median are significant. Further, the standalone firms on average appear to be less profitable than their business group counterparts.

5.2 Regression results

Linguistically weighted and conventional director network

The estimation result of equation 1(a) is given in Columns 1-3 of Table 2.1. Column 1 indicates a unit change in linguistically weighted degree measure can potentially increase Q-ratio by 0.77

units. Columns 2 and 3 shows that a unit changes in betweenness and closeness measures can improve Q-ratio by 0.85 and 0.42 units respectively. The regression results suggests that in presence of homophily in boards based on linguistic affiliation of directors, the director network and firm performance are positively related in accordance to the resource dependence hypothesis. The regression results of benchmark model (equation 1(b)) using conventional degree, betweenness and closeness measures are given in Columns 4, 5 and 6 of Table 2.1 respectively. The various director network measures are positively related to adjusted Tobin's-Q ratio for listed firms supporting the resource dependence view of boards. For example, Column 1 indicates that an incremental increase in the number of connections of the board can be associated with a 0.58 unit rise in adjusted Q-ratio.

To assess whether the coefficients of linguistically weighted director network measures differ from that of the conventional measures, I use Chi-square test for difference in means and the results are presented in Table 2.2. It is evident that the coefficients of linguistically weighted degree, betweenness and closeness measures are higher than the conventional measures at usual level of significance. The differences in mean test indicate that the relation between director network and firm performance becomes stronger when the network measures accounts for the homophily based on linguistic characteristics of the directors. In support of hypothesis 1a, I find that more interaction among directors with similar linguistic background enables better coordination and faster decision making. Such smooth functioning of the board is beneficial for performance of publicly listed firms in India.

Given that linguistically weighted director network is positively related to firm performance, I analyze whether the effect is varies with firm characteristics like engaging in research activities. Research projects are generally capital intensive and require board approvals. If linguistic homophily smoothen board functioning; then obtaining approval from directors on research projects can be easier and less time consuming. If linguistic homophily in directorial ties is beneficial for research then linguistically weighted director network can be expected to be more important for firms involved in research. I define a dummy 'R&D' which takes the value one if firm has incurred R&D expenses and zero otherwise and introduce a 'Director network" and 'R&D' dummy interaction term in equation 1(a). The results are presented in Table 2.3. All the

network measures continue to be positively related to Q-ratio. The interaction is also positive and significant. For example, Column 1 gives that a unit rise in linguistically weighted degree is associated with 1.12 units rise in Q-ratio for firms involved in research compared to 0.55 unit rises in Q-ratio for other firms. Thus, linguistically weighted director network appears to be more important for firms involved in research activities.

Standalone versus group firms

To analyze how ownership structure like affiliation to a business group can affect the importance of director network, I estimate equation 1(a) for the sub-samples of standalone and group firms. The group firms dominate the sample with 1860 firm-year observations as compared to 1497 firm-year observations for standalone firms. Table 3.1 present the regression results. The linguistically director network measures are positive and significant for standalone firms (Columns 1-3) at one percent level of significance. Contrary to standalone firms; only degree and betweenness measures are positive and significant for the set of group firms. The closeness measure is positive but insignificant. This is to say that a unit rise in closeness measure can be linked with 0.62 units rise in Q-ratio for standalone firms and is unrelated with Q-ratio of group firms. Further, the magnitudes of the coefficients of degree and betweenness measures are higher for standalone firms vis-à-vis group firms. Column 1 and 4 suggest that a unit rise in degree measure can be associated with 1.23 units rise in Q-ratio of standalone firms and only a 0.47 unit rise in the Q-ratio the business group firms.

I also estimate equation 1(b) for standalone and group firms separately to compare and contrast the results between conventional and linguistically weighted director network measures. The results are presented in Table 3.2. The conventional director network measures are positive and significant for the set of standalone firms. The degree and betweenness measures are positive and significant for group firms and closeness measure continues to remain positive and insignificant. However, the magnitudes of the coefficients are consistently smaller than the linguistically weighted director network measures both for set of standalone and group firms.

The results suggest that standalone firms appear to heavily rely on director network for access to information and resources which may not be easily available in the external market. Further, a large network helps the director to establish reputation in the market. On the other hand group firms already have access to information available within the group and are likely to have a reputation in the marketplace. Further, in presence of entrenchment hypothesis, the controlling shareholder often takes decisions in order to extract private benefits at the cost of minority shareholders of the firms and as a result the director network is expected to be less important. However, accounting for homophily in the network due to linguistic similarity, the positive effect on account of better coordination and ability to reach consensus faster strengthens the positive association between the conventional director network and firm performance relation for the standalone as well as group firms. Even though director network appears be less important in the decision making process for group firms; considering homophily in directorial ties highlights the benefits on account of coordination among the directors belonging to the same linguistic community. Overall I do find support for hypothesis 2 which states that linguistically weighted director network is more important for standalone firms vis-à-vis their business group counterparts.

Effect of board diversity

In order to estimate the effect of board diversity on director network and firm performance relation I introduce a 'Director Network' variable and 'Majority' dummy interaction term in the model. The regression results using linguistically weighted director network measures are given in Columns 1-3 of Table 4.1. The coefficient of linguistically weighted director network variable given by degree, betweenness and closeness measures continue to be positive and significant. The estimate of interaction term is negative and significant at usual level of significance; however, the net effect is still positive in all the cases. For example, Column 1 gives that a unit rise in linguistically weighted degree measure is associated with 0.78 unit rise in Q-ratio for firms with whose boards are not dominated by directors of a particular linguistic community vis-à-vis 0.55 unit rise for less linguistically diverse boards. The results suggest that when more than fifty percent of the board comprises of directors of the same linguistic community; the adverse effect of lack of diverse perspectives on issues sets in and has a moderating effect on the positive

relation between director network and firm performance. In accordance to hypothesis 3, I find that boards dominated by directors of a particular linguistic community affect the director network and firm performance relation. It also follows that even though homophily based on linguistic affiliation of directors can lead to better coordination and efficient functioning of the board; some amount of diversity in board composition is still desirable.

Further, to assess the effect of linguistic composition of boards by not accounting for homophilous nature of directorial ties; I estimate the model using conventional director network measures. The results are presented in Columns4-6 of the Table 4.1. Similar, to linguistically weighted models, the coefficients of conventional director network measures continues to positive and significant and the interaction term is negative and significant. The net effect remains positive, however the magnitude of the positive coefficient for linguistically less diverse boards are smaller on considering conventional network measures. I also test whether the difference in the coefficients of linguistically weighted and conventional director network measures are statistically significant. The difference in mean tests reported in Table 5.2 suggests that in presence of homophilous directorial ties, the negative effect of having less culturally diverse board is lower than instances when ties across all directors are assumed to be same. The signs of the control variables continue to remain the similar to results discussed above.

5.3 Robustness checks[6]

I carry out additional analyses to check for the robustness of the results discussed above. The board of directors is responsible for setting firm's long run objectives and assess whether the current state of operations are aligned to the long term goal. The firm level strategic decisions aimed at fulfilling long term goals of the firm may not yield observable results in the current period. Firms with larger director network can be in better position to implement best management practices or implement environmentally friendly policies on account of access to information and resources. These can be time consuming and the effect may not be reflected in the financial statement immediately. In order to address this concern, I re-estimate performance equation using one year ahead performance and also two year average performance as dependent

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[6] Results can be made available on request.

variables. The two year average Q-ratio is computed as the mean of current period and one year ahead realized Q-ratio. The results remain similar on considering one-year ahead performance as well as two year average firm performance.

Tobin's Q is generally considered as a proxy for the market valuation of the firm. The valuation can be influenced by future investment opportunities available to the firm and several studies have included growth opportunities as a control in firm performance model (Yermack, 1996; Sarkar and Sarkar, 2009). I include R&D, advertising and marketing expenses to total income as a proxy for growth opportunities in performance equation as an additional control. The positive association between linguistically weighted director network and firm performance is robust to the inclusion of growth opportunities as an additional control variable.

Further, I re-estimate results using accounting measures like ROA, STA and NVA. The major advantage of the accounting measures of performance is that is gives the effect of director network on current firm performance based on reported accounting information. I consider ROA defined as the ratio of profit before interest and taxes to book value of total assets as a dependent variable. STA is defined as total income divided by total assets. NVA is defined as the ratio of profit after tax to total assets. The results do not change on considering accounting measures of firm profitability.

6. Summary and conclusions

The directors are social beings and may not be expected to communicate equally with other fellow directors and the differential rate of communication within the network can alter the conventional director and firm performance relation. The present study captures the differences in rate of interaction due to linguistic backgrounds of the director. The study finds that director network and firm performance is positively related in the Indian context. However, not accounting for the presence of linguistic homophily in the network underestimates the importance of director network. Linguistic homophily strengthens the positive association as the firm benefits from resources it can access through it directors and also from reduced frictions within the board. It also finds that accounting for linguistic homophily is more important for

firms engaging in research activities. Further, it finds that director network is more important for the set of standalone firms. The groups firms often have an established reputation and also have access to resources available to other firms within the group. As a result their reliance on director network for access to information is expected to be lower; however standalone firms heavily rely on director network for access to non-market information and for building reputation in the marketplace.

In this study I also analyze whether having a linguistically less heterogeneous boards enhances performance by fostering higher board level coordination. The result suggests boards where more than half of the directors belong to the same linguistic community; it has a moderating effect on the director network and firm performance relation. It indicates that even though homogeneous board composition enhances coordination, diversity in boards is important to ensure availability of diverse perspectives for better problem solving ability. The result also provides a case for board diversity for economic reason in addition to moral and ethical considerations. The presence of linguistic homophily suggests that if boards are comprised of linguistically similar people then it leads to better board level coordination. However, it is important to note that this concept does not undermine the importance of board diversity. Increasingly having a diverse board is becoming a regulatory requirement across the world. In India previously there were no mandate for maintain diversity in boards; however the new Companies Act 2013 requires certain corporations to have at least one women director. In addition to gender diversity there is no other mention of importance of director demographics.

The study is an early attempt in to highlight the importance of demographic feature like linguistic affiliation of directors in shaping director network and firm performance relation. It highlights that not accounting for social phenomenon like homophily actually underestimates the importance of director network for firms in India. Further, it also suggests homogeneous board composition fosters coordination, but having people from diverse backgrounds is important for ensuring diverse perspectives on issues.

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Table 1: Descriptive statistics

The table presents summary statistics for the sample of firms as well as business group firms and standalone firms within the sample. Degree is the number of direct board connections with other firms, closeness is the inverse of network path distance between the firm from other firms and betweenness is the measure of whether a firm lies on the path connecting other two firms All the network measures are linguistically weighted. Age is given by the number of years since incorporation. Firm size is defined as the logarithm of total assets during the year. Board size is simply the number of directors on the board of a firm. Promoter's share gives the percent of shares held by the promoter(s) of the firm during the year. Leverage ratio gives the debt equity ratio. The first two columns gives the mean and median for group firms, the third and fourth columns gives the mean and median for non-group firms and last two columns corresponds to the full sample of firms. The significance of mean is based on two tailed difference of mean t-tests. The significance in median is based on results of Wilcoxon signed rank tests for the difference of medians.

	Group firms		Standalone firms		All firms	
	Mean	Median	Mean	Median	Mean	Median
Degree	0.17	0.15	0.11***	0.08***	0.14	0.12
Closeness	0.19	0.26	0.13***	0.13***	0.16	0.16
Betweenness	0.07	0.05	0.04***	0.02***	0.05	0.03
Adjusted Tobin's Q-ratio	0.82	0.70	0.74***	0.61***	0.78	0.66
Age (years)	34.06	27.00	26.86***	21.00***	30.69	23.00
Firm size (log of assets)	8.70	8.66	8.08***	7.88***	8.41	8.29
Board size (integer)	9.18	9.00	8.42***	8.00***	8.83	8.00
Promoter's share (%)	52.57***	52.39***	54.04	55.03	53.23	53.56
Leverage ratio	0.96	0.70	0.90**	0.62*	0.93	0.66

Significance at 1 percent, 5 percent and 10 percent are denoted by ****, ** and * respectively.

Table 2.1: Director network and firm performance relation

The table reports the parameter estimates obtained from the regression of linguistically weighted and conventional director network measure (degree, betweenness and closeness measures) on firm performance. Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. The dependent variable is adjusted Tobin's Q-ratio defined as (market value of equity + book value of debt) / book value of assets. Columns 1-3 gives the effect of linguistically weighted director network and Column 4-6 gives the effect of conventional network measure on firm performance. The values in parenthesis give the standard errors

clustered at the individual group level. The independent variables are a set of firm characteristic variables, group dummy, industry dummies and year dummies. The group dummy captures the membership in a business group.

Variable	Linguistically weighted director network			Conventional director network		
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Constant	0.449*	0.282	0.225	0.281	0.211	0.072
	(0.252)	(0.241)	(0.247)	(0.237)	(0.237)	(0.234)
Degree	*0.765***			*0.588***		
	(0.166)			*(0.124)*		
Betweenness		*0.854***			*0.710***	
		(0.178)			*(0.151)*	
Closeness			*0.419***			*0.080**
			(0.141)			*(0.036)*
Group dummy	0.034*	0.030	0.043**	0.025	0.031	0.048**
	(0.019)	(0.020)	-0.017	(0.020)	(0.020)	(0.020)
Age	-0.075***	-0.073***	-0.072***	-0.073***	-0.071***	-0.069***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Board size	-0.139***	-0.035	-0.059	-0.048	0.003	0.009
	(0.044)	(0.032)	(0.040)	(0.034)	(0.031)	(0.032)
Promoter's share	0.002***	0.002**	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm size	0.048***	0.051***	0.056***	0.049***	0.051***	0.058***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Leverage ratio	-0.068***	-0.069***	-0.073***	-0.068***	-0.069***	-0.074***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3357	3357	3357	3357	3357	3357
R-squared	0.169	0.171	0.164	0.169	0.171	0.163

Note: Significance at 1 percent, 5 percent and 10 percent levels are denoted by ****, **, * respectively against the parameter estimate values.

Table 2.2: Linguistically weighted director network vis-à-vis conventional director network

The table presents the result of Chi-square test for difference in means of linguistically weighted and conventional director network measures (degree, betweenness and closeness). Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. The first two columns give the estimated coefficient of weighted and conventional director measures respectively. Third column gives the Chi-square test statistic value and the last column gives the associated probability.

Director network measure	Estimated coefficient- Linguistically weighted director network	Estimated coefficient- Conventional director network	Chi-square	P-value
Degree	0.765	0.588	5.04	0.025**
Betweenness	0.854	0.710	4.34	0.037**
Closeness	0.419	0.080	8.98	0.003***

Note: Significance at 1 percent and 10 percent levels are denoted by ****, * respectively against the parameter estimate values.

Table 2.3: Effect of firm level research activities on linguistically weighted director network and firm performance relation

The table reports the parameter estimates obtained from the regression of linguistically weighted director network measure (degree, closeness and betweenness) and interaction of linguistically weighted director network with R&D dummy on firm performance. The dependent variable is adjusted Tobin's Q-ratio defined as (market value of equity + book value of debt) / book value of assets. Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm and other firms. The R&D dummy takes the value one for firms involved in research activities and zero otherwise. The values in parenthesis give the standard errors clustered at the individual group level. The independent variables are a set of firm characteristic variables, group dummy, industry dummies and year dummies. The group dummy captures the membership in a business group.

	Column 1	Column 2	Column 3
Constant	0.478*	0.322	0.282
	(0.251)	(0.245)	0.236

	Column 1	Column 2	Column 3
Degree	*0.552****		
	(0.167)		
Betweenness		*0.555****	
		(0.184)	
Closeness			*0.309***
			0.142
Linguistically weighted director network*R&D	*0.556****	*0.883****	*0.503****
	(0.111)	*(0.199)*	*(0.110)*
Group dummy	0.034*	0.031	0.041**
	(0.020)	(0.020)	(0.020)
Age	-0.085***	00.081***	-0.081***
	(0.017)	(0.017)	(0.017)
Board size	-0.134***	-0.038	-0.072*
	(0.044)	(0.032)	(0.041)
Promoter's share	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)
Firm size	0.048***	0.050***	0.055***
	(0.008)	(0.008)	(0.008)
Leverage ratio	-0.065***	-0.066***	-0.070***
	(0.010)	(0.010)	(0.010)
Industry dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
No. of observations	3357	3357	3357
R-squared	0.177	0.177	0.171

Table 3.1: Linguistically weighted director network and firm performance: Standalone firms versus group firms

The table reports the parameter estimates obtained from the regression of linguistically weighted director network measure (degree, betweenness and closeness measures) on firm performance for standalone and group. Degree is the

number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. The dependent variable is adjusted Tobin's Q-ratio defined as (market value of equity + book value of debt) / book value of assets. Columns 1-3 gives the results of linguistically weighted director network on firm performance for the sub-sample of standalone firms. Column 4-6 gives the relation of linguistically weighted director network on firm performance for the sub-sample of business group firms. The values in parenthesis give the standard errors clustered at the individual group level. The independent variables are a set of firm characteristic variables, industry dummies and year dummies.

Variable	Standalone firms			Group firms		
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Constant	0.762***	0.453***	0.422***	0.544**	0.456**	0.394*
	(0.181)	(0.150)	(0.158)	(0.217)	(0.206)	(0.208)
Degree	*1.228***			*0.469***		
	(0.243)			*(0.212)*		
Betweenness		*1.392***			*0.572**	
		(0.250)			*(0.232)*	
Closeness			*0.617***			*0.252*
			(0.186)			*(0.240)*
Age	-0.106***	-0.099***	-0.090***	-0.069***	-0.069***	-0.068***
	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)
Board size	-0.203***	-0.037	-0.076	-0.075	-0.014	-0.021
	(0.067)	(0.049)	(0.058)	(0.059)	(0.045)	(0.062)
Promoter's share	0.003***	0.003***	0.003***	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm size	0.028**	0.033***	0.037***	0.063***	0.064***	0.069***
	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Leverage ratio	-0.043***	-0.042***	-0.047***	-0.092***	-0.092***	-0.096***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	1497	1497	1497	1860	1860	1860

Variable	Standalone firms			Group firms		
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
R-squared	0.149	0.152	0.140	0.203	0.204	0.200

Note: Significance at 1 percent, 5 percent and 10 percent levels are denoted by ****, **, * respectively against the parameter estimate values.

Table 3.2: Conventional director network and firm performance: Standalone firms versus group firms

The table reports the parameter estimates obtained from the regression of conventional director network measure (degree, betweenness and closeness measures) on firm performance for standalone and group. Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. The dependent variable is adjusted Tobin's Q-ratio defined as (market value of equity + book value of debt) / book value of assets. Columns 1-3 gives the results of conventional director network on firm performance for the sub-sample of standalone firms. Column 4-6 gives the relation of conventional director network on firm performance for the sub-sample of business group firms. The values in parenthesis give the standard errors clustered at the individual group level. The independent variables are a set of firm characteristic variables, industry dummies and year dummies.

Variable	Standalone firms			Group firms		
	Column 1	Column 2	Column3	Column 4	Column 5	Column 6
Constant	0.536***	0.356**	0.215	0.407**	0.398*	0.308
	(0.153)	(0.146)	(0.145)	(0.205)	(0.205)	(0.203)
Degree	*1.109****			*0.298**		
	(0.178)			*(0.158)*		
Betweenness		*1.152****			*0.434***	
		(0.215)			*(0.197)*	
Closeness			*0.121****			*0.030*
			(0.043)			*(0.073)*
Age	-0.108***	-0.097***	-0.084***	-0.067***	-0.068***	-0.067***
	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)
Board size	-0.092*	0.010	0.012	-0.006	0.017	0.027

Variable	Standalone firms				Group firms	
	Column 1	Column 2	Column3	Column 4	Column 5	Column 6
	(0.051)	(0.047)	(0.048)	(0.046)	(0.043)	(0.044)
Promoter's share	0.003***	0.003***	0.003***	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm size	0.027**	0.034***	0.040***	0.064***	0.064***	0.071***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Leverage ratio	-0.041***	-0.043***	-0.048***	-0.092***	-0.092***	-0.096***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	1497	1497	1497	1860	1860	1860
R-squared	0.156	0.151	0.139	0.202	0.203	0.200

Note: Significance at 1 percent, 5 percent and 10 percent levels are denoted by ****, **, * respectively against the parameter estimate values.

Table 4.1: Effect of board diversity on director network and firm performance relation

The table reports the parameter estimates obtained from the regression of director network measure (degree, betweenness and closeness measures) and interaction between director network and board diversity on firm performance. Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. 'Majority' dummy captures the information whether more than half of the board is composed of directors of a particular linguistic community. The dependent variable is adjusted Tobin's Q-ratio defined as (market value of equity + book value of debt) / book value of assets. Columns 1-3 gives the effect of weighted director network based on linguistic affiliation of directors and Column 4-6 gives the effect of conventional network measure on firm performance given diversity of the board. The values in parenthesis give the standard errors clustered at the individual group level. The independent variables are a set of firm characteristic variables, group dummy, industry dummies and year dummies. The group dummy captures the membership in a business group.

Variable	Linguistically weighted director network			Conventional director network		
	Column 1	Column 2	Column3	Column 4	Column 5	Column 6
Constant	0.447*	0.296	0.255	0.301	0.225	0.108

Variable	Linguistically weighted director network			Conventional director network		
	Column 1	Column 2	Column3	Column 4	Column 5	Column 6
	(0.253)	(0.242)	(0.241)	(0.238)	(0.238)	(0.235)
Degree	*0.784***			*0.624***		
	(0.166)			*(0.125)*		
Betweenness		*0.987***			*0.829***	
		(0.190)			*(0.157)*	
Closeness			*0.506***			*0.104***
			(0.145)			*(0.037)*
Director network*Majority	*-0.231**	*-0.481**	*-0.250***	*-0.209***	*-0.498***	*-0.066***
	(0.106)	*(0.196)*	*(0.092)*	*(0.077)*	*(0.181)*	*(0.023)*
Group dummy	0.035*	0.031	0.043*	0.026	0.032	0.048**
	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Age	-0.074***	-0.072***	-0.071***	-0.072***	-0.070***	-0.068***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Board size	-0.129***	-0.036	-0.061	-0.047	0.001	0.008
	(0.045)	(0.032)	(0.040)	(0.034)	(0.031)	(0.032)
Promoter's share	0.002**	0.002***	0.002**	0.002**	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm size	0.047***	0.049***	0.053***	0.046***	0.049***	0.056***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Leverage ratio	-0.068***	-0.068***	-0.071***	-0.067***	-0.068***	-0.072***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3357	3357	3357	3357	3357	3357
R-squared	0.170	0.172	0.166	0.172	0.172	0.165

Note: Significance at 1 percent and 5 percent levels are denoted by ****, **respectively against the parameter estimate values.

Table 4.2: Linguistically weighted director network vis-à-vis conventional director network given board diversity

The table presents the result of joint Chi-square test for difference in means of weighted and conventional director network measures (degree, betweenness and closeness) and interaction between director network and majority board composition dummy. Degree is the number of direct board connections with other firms; betweenness is the measure of whether a firm lies on the path connecting other two firms and closeness is the inverse of network path distance between the firm from other firms. The first two columns give the estimated coefficient of weighted and conventional director measures respectively. Third column gives the Chi-square test statistic value and the last column gives the associated probability.

Director network measure	Estimated coefficient- Linguistically weighted director network	Estimated coefficient- Conventional director network	Chi-square	P-value
Degree	0.784	0.624		
			4.81	0.091*
Degree*Majority	-0.231	-0.209		
Betweenness	0.987	0.829		
			6.05	0.049**
Betweenness*Majority	-0.481	-0.498		
Closeness	0.506	0.104		
			15.51	0.000***
Closeness*Majority	-0.250	-0.066		