Corporate Finance Policies and Social Networks*

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Abstract

Social network theory suggests that individuals' preferences and decisions are affected by the actions of others. Such decision externalities arise from constraints on our ability to process or obtain costly information. This paper provides evidence that managers are influenced by their social peers when making corporate finance policy decisions. I create a matrix of social ties using data on current employment, past employment, education, and other activities for key executives and directors of the board for US companies. I find that the more social connections two companies share with each other, the more similar both their level and change over time in investment. Furthermore, companies positioned more centrally in the social networks invest in a less idiosyncratic way. Finally, more socially connected firms exhibit better economic performance. To address endogeneity concerns, I find that two companies behave less similarly when an individual who connects them dies.

1 Introduction

Top managers and directors are connected through extensive social networks. For example, William Herbert Gray III's biography illustrates the span of social ties among directors and key executives in the United States. In 2001 Mr. Gray was on the board of directors of 13 companies. Through his directorship network, he met regularly with 54 people on various board committees and interacted in total with 124 directors and key executives. His past employment network extends to 239 directors and key executives that at one point in time were working with him. His two Masters and one Bachelors degrees connect him with a school alumni network of 337 managers. Finally, Mr. Gray is currently a member of various non-profit organizations and he shares such memberships with 7 other directors and key executives.

The purpose of this paper is to investigate whether and how social, educational and professional networks play a role in the way companies make managerial decisions. I find that the more connections two companies share with each other, the more similar is both their level and change over time in investment. The global position in the social network is also important. The more centrally located a company is in the network, the less idiosyncratic is its investment strategy relative to the other members of the network. Social connections also have value implications: more socially connected firms exhibit better economic performance.

The economic literature abounds with theoretical models on how social networks influence economic behavior. Ellison and Fudenberg (1993) and (1995) study the local and global effects of word-of-mouth communication and social networks on decision making, and they conclude that "economic agents must often make decisions without knowing the costs and benefits of the possible choices. Given the frequency with which such situations arise, it is understandable that agents often choose not to perform studies or experiments, but instead rely on whatever information they have obtained via casual word-of-mouth communication." Social network theory calls decision externality the tendency of individuals to change their preferences and decisions because of the actions of others.[1] Reliance on decision externalities is widespread in society: for example, when we have to choose a restaurant or a movie, we are constrained in our ability to process or obtain costly information, therefore we give weight to other people's actions. The social science literature offers both rational and boundedly rational explanations to imitation, social learning and conformity.[2]

Unfortunately, little has been done empirically to demonstrate that such decision externalities occur. In particular, no published work has investigated whether and how social networks influence the way managers make managerial decisions. This paper offers empirical evidence supporting the hypothesis that managers are influenced by their social peers when they face corporate finance policy decisions. Thus, decision externalities are an important driver of managerial decisions.

First, I assemble a set of social, educational and professional network matrices using biographical information of over 30,000 key executives and directors of over 2,100 companies. These social ties are tracked over the span of 7 years, from 2000 to 2006. To my knowledge, this is the largest dynamic social network database ever assembled for an academic study in economics. Individual connections are then aggregated by company pairs to define a measure of social connectivity between firms. The corporate finance policy used in this study is the investment decision. Investment is a natural choice of corporate policy because it is a highly

[1]For an introduction to social networks and decision externalities, refer to Watts (2003). For a more in-depth discussion on social networks and organizations, refer to Kilduff and Tsai (2003).

[2]A behavior that takes into considerations the actions of other individuals can be entirely rational. For example, Bikhchandani, Hirshleifer, and Welch (1992) show how people conform to social norms that become informational cascades, under a strictly rational model. In finance, Adams and Ferreira (2007) shows that management-friendly boards can be optimal when the benefits of getting better advice from the board are greater than the costs of tougher monitoring. Subrahmanyam (2008) studies social connections between CEOs and members of the board of directors. A tradeoff exists between a better CEO selection and the cost of inadequate monitoring.

discretionary decision made by key executives and approved by the board of directors.

Using cross-sectional, panel and instrumental variable regressions, this paper provides evidence of a causal relationship between social networks and corporate finance policies. First, I investigate the local connections between pairs of companies. I find that companies are indeed influenced in their policy decisions by their nearest social neighbors: the more social connections two companies share with each other, the more similar is their investment behavior. In addition, two connected companies change their investment strategy over time more similarly than two companies that are less socially connected. Because of the longitudinal nature of the dataset, I can control not only for year fixed effects, but also for firm-heterogeneity. Results are robust to controlling for pair fixed effects. I also address endogeneity concerns using the death of directors as exogenous shocks to the social network. With an instrumental variable regression, I find that two companies behave less similarly when an individual who connects them dies, therefore showing that changes in social connections have a causal effect on changes in corporate policies. Second, I use three different measures of network centrality to investigate how the position of a company in the social network affects its investment strategy. I find that companies more centrally located in the social network have a less idiosyncratic investment strategy. Information flows more freely and at lower cost through the social networks. A possible alternative explanation is that managers with similar background and affiliations have a similar style of management. I define style variables to isolate and control the effects of management style from the effects of management style. Third, companies that are more socially connected have a better operating performance even after controlling for industry and other control variables. This suggests not only that companies are influenced by their social connections, but also that they exploit their competitive position in the network to make better policy decisions and to improve their bottom line.

This paper relates to two strands of literature. First, I contribute to research on managerial decision making. Several papers in the last decade have studied the large heterogeneity in the way companies make corporate finance policy decisions. Bertrand and Schoar (2003) show that CEOs have unique styles of managing corporations that are carried over when CEOs move from one company to another. Malmendier and Tate (2005) argue that managerial overconfidence can account for corporate investment distortions, finding that investment of overconfident CEOs is significantly more responsive to cash flow, particularly in equity-dependent firms. Finally, Frank and Goyal (2007) finds that differences among CEOs account for a great deal of the variation in leverage among firms, therefore explaining some of the firm fixed effects on capital structure stressed by Lemmon, Roberts, and Zender (2008).

The paper also contributes to the literature on the impact of social networks in finance. With respect to asset pricing, Cohen, Frazzini, and Malloy (2008) focus on the education network between mutual fund managers and corporate board members. They find that mutual fund managers invest more and perform significantly better on stock holdings for which the board members went to school together with the mutual fund managers. This suggests that social networks may be an important mechanism for information flow into asset pricing. Brown, Ivkovic, Smith, and Weisbenner (2007) provide evidence of a causal relation between an individual's decision to own stock and the average stock market participation of the individual's home community. With respect to corporate governance, Hwang and Kim (2008) shows that CEO compensation is higher in companies where directors are more socially connected to CEOs. Fracassi and Tate (2008) finds that socially powerful CEOs hire directors that are more socially connected with them, and that leads to weaker monitoring, with more value-destroying mergers and less company-prompted restatements. Barnea and Guedj (2007) look at the network generated by the interlocking directorships among companies in the US. They find that directors who are more centrally located in the network tend to award their CEOs higher compensation, suggesting that social networks impact the inner workings of boards and firm governance. Nguyen-Dang (2007) investigates the French elite circles and finds that socially well-connected CEOs are less likely to be dismissed for poor performance, and more likely to find new and good employment after a forced departure.

Despite the growing literature on social networks and economics, no research has focused on the relationship between corporate finance policy decisions and social networks. My research is unique in several ways. First and foremost, this paper is the first to bridge studies on the heterogeneity of corporate policies with studies on social networks and finance. Second, previous studies have considered only one type of social connection, while this paper explores a multitude of social connections, ranging from current and past professional, social and educational relationships[3]. Third, the scale of the project is unmatched by any other study on social networks and economics. More than 30,000 individuals and 2,100 companies over seven years from 2000 to 2006 are included in the sample. The longitudinal nature of the sample is especially useful to distinguish with-in (panel) and between (cross-sectional) effects.

The remainder of the paper is structured as follows: Section 2 presents the data and provides the definitions of social connectivity. Section 3 shows the main results of the paper. Section 4 concludes the paper.

[3]Only Fracassi and Tate (2008) uses the same range of social connections.

2 Data and Social Connection Definitions

Each public company in the United States is required by the SEC to provide information about the board of directors and the top five earners.[4] Boardex of Management Diagnostics Limited, an independent, privately owned corporate research company, collects and classifies such information and supplements it with additional publicly-available information. For this paper, I use a novel panel dataset that includes all directors on the board and key executives for companies in the S&P 500 (large cap), S&P400 (mid cap) and S&P600 (small cap) indices as well as for inactive/delisted companies. Boardex supplies biographical information on the current employment, the past employment, the education and other activities[5] for each individual from 1999 to 2007.

Using such biographical information, I define five networks that represent the social relationships among individuals in the study:

- *Current Employment Network (CE)*: two individuals are socially connected through their current employment network if they work in the same company and sit together either on the board of directors or on the top management group. The CE network includes both the traditional interlocking directorship network where two companies share the same director, as well as connections where individuals from two companies sit on the board of a third company.

[4]Boardex provides information also on mid-level management, with biographical information gathered from publicly-available sources. For this study, I limited my analysis to the top key executive and directors on the board for two reasons: First, to avoid introducing sample selection biases due to the heterogeneity in the optional disclosure policy among companies. Second, mid-level management are less involved in the overall corporate finance policy decision making process.

[5]Boardex provides a list of all current and past board positions and current and past employer, with specific information on job description, committees served, date started in the organization and in the current role. In addition, it provides a list of all the undergraduate and graduate programs attended, with details on the institution, degree awarded, concentration and degree date and a list of current and past membership to non-professional organizations, such as golf clubs, non-profit organizations, and business roundtables, with details on the role served, date started and ended in the organization.

- *Past Employment Network (PE)*: two individuals are socially connected through their past employment network if they have worked in the past in the same company at the same time, either on the board of directors or on the top management group.

- *Education Network (ED)*: two individuals are socially connected through their education network if they went to the same school and graduated within one year of each other with the same professional, master or doctorate degree[6].

- *Other Activities Network (OA)*: two individuals are socially connected through their other activity network if they share membership in clubs, organizations or charities, and had an active role in it[7].

- *Social Network Index (SNI)*: two individuals are generically socially connected if they are connected in any of the above networks.

For example, Richard Karl Goeltz, an independent director of Delta Airlines and Aviva, went to Columbia Business School for his MBA in 1966 together with Patrick T Stokes, Chairman of Anheuser-Busch Cos Inc. Because Mr. Goeltz and Mr. Stokes went to the same school at the same time and earned the same professional degree, they are connected in the ED network. Mr. Goeltz also worked in the past at Seagram Co. in various positions up to CFO, from 1970 to 1991, together with Mrs. Marie-Josee Kravis, current director of IAC Corp and Ford Co, and therefore they are connected in the PE network.

Using the biographical information of key executives and directors of the largest

[6]Academic degrees generically indicated as Bachelor, BS, BA, mA or MS do not qualify as social connections. The choice of using master or professional degrees, such as MBA, JD or MD, substantiate the hypothesis that two individuals actually met and spent some time together. Such definition of education network is similar but even more restricted than the one used in other papers (see Cohen, Frazzini, and Malloy (2008),

[7]Active role means that the role description needs to be more than just "members". Example of the most frequent active roles are "Trustee", "President", "Advisor", Board Member, ... The Other Activity dataset does not report the starting and ending date for the majority of the observations. Therefore the feature that positions need to occurs at the same time is not required for the OA network.

companies in US, I therefore build a 30,023 by 30,023 non-directional (symmetric) binary sociomatrix, referred in the social network literature also as adjacency matrix, for each network for each year, representing the social connections existing among the entire universe of individuals in the sample. Individual connections are then aggregated by company pairs: for every possible pair of companies in the sample, I define "Strength" between two companies as the total number of social ties that exist between individuals in the two companies.[8] Therefore, the individual matrices are aggregated into company matrices: for each network and each year, I create a 2,101 by 2,101 valued matrix in which each cell value is the strength of the connection, representing the number of social connections that the two companies share. A unique feature of this study is the dynamic nature of the sociomatrices: I can track how connections between firms change over the years and therefore enable a longitudinal analysis of the relationship between corporate finance policies and social networks. Table 1 tabulates the summary statistics of the social network matrices[9]. All social networks studied in this paper exhibit a single large cluster (component). However, within the large cluster , some companies are in the center of the network and other companies are on the fringe, as shown in Figure 1.

Three measures of centrality commonly are used in social network literature to appraise the position of a company in the social network.[10]

- *Degree:* sum of all direct valued links that each firm has with other companies in the network, divided by the number of companies in the network. Degree is the measure that most takes into account the information that a company is exposed to, because it

[8]Each individual can only contribute one tie for each pair of companies. This rule has been set to avoid that interlocking directorships were overweighed in the Current Employment network.

[9]Additional social networks summary statistics concerning the correlations between the different sociomatrices are available by the author and not reported in the paper.

[10]For an extensive explanation of the centrality measures, refer to Wasserman and Faust (1997). Other studies, such as Barnea and Guedj (2007), used similar network centrality measures in the context of corporate governance

measures how many companies the firm is connected through.

- *Betweenness:* number of shortest paths linking two companies in the network that pass through a company. This measure is the most effective in capturing the absolute position of a company in the network. If a company has a high degree of betweenness, that means that it is in a critical position where a large flux of information passes through the node. Betweenness measures the connections beyond the first neighbors, and it takes into account how connected the neighbors and the neighbors' neighbors are. Betweenness has been used in the network literature for fast and low cost information spreading, such as internet networks and virus networks.

- *Closeness:* average number of steps that a company needs to take within the social network to reach any other firm. This measure captures the connection to highly influential companies. Closeness has been used in the social network literature as a measure of influence with respect to centrality, rather than information flow. For example, if I am connected with a very popular person, I can reach and influence many other individuals through him, but I am not necessarily exposed to the information that passes through the popular individual.

The social network dataset is then merged with stock price and accounting data from CRSP/COMPUSTAT. The final sample tracks 2,101 firms and 30,023 individuals from 1999 to 2007. Investment, defined as the ratio of capital expenditure over property, plant & equipment, is the corporate finance policy variable. Investment is a discretionary decision made by key executives and approved by the board of directors. In addition, investment is only partially persistent over time, and exhibits large heterogeneity across firms, as shown in the summary statistic Table 2.

3 Empirical Analysis and Results

This section presents the results of the empirical analysis on the relationship between social networks and corporate finance policy decisions. First, I investigate the connections between a company and its nearest social neighbors: I study the relationship between the strength of social connections and the similarity of investment policy for all possible pairs of companies in the sample (Pair Model). Second, I look at the entire network, and investigate how the global position of a company in the social network influences its investment behavior(Centrality Model). Third, I look at the relationship between the global position in the social network and the operating performance (Performance Model).

3.1 F-Test Model

First, I run a F-Test of joint significance of the strength coefficient to determine whether social connections are important determinants of corporate finance policy decisions. More specifically, the following regressions and F-Value are estimated:

$$\text{1- Full Model: } Policy_{i,t} = \alpha_0 + \alpha_1 X_{Pi,t} + \sum_{j=1}^{n} \alpha_{2,i,j} Strength_{i,j,t} + \varepsilon_{i,t}$$

$$\text{2- Restricted Model: } Policy_{i,t} = \alpha_0 + \alpha_1 X_{Pi,t} + \varepsilon_{i,t}$$

$$\text{F-Value: } F = \left(\frac{RSS_1 - RSS_2}{RSS_2}\right) \cdot \left(\frac{n - p_2}{p_2 - p_1}\right)$$

where the regressor $Strength_{i,j,t}$ represents the number of social connections between company i and company j at time t,$X_{Pi,t}$ are control variables[11], $Policy_{i,t}$ is Capital

[11]For the F-test, the control variables used are size (Total Assets and Total Assets Squared), investment opportunities (Tobin's Q), profitability (Cash Flow), the interaction of size and investment opportunities, and year and industry (Fama French 49 industry code) dummies. Refer to the appendix for a definition of the financial variables.

Expenditure over PP&E, RSS is the residual sum of square, n is the number of observations, and p is the number of parameters in each model.

The null hypothesis is that the social network variable coefficients are jointly equal to zero. Table 3 shows that both the aggregate SNI measure and each network component CE, PE, ED, and OA increase the explanatory power of the model using investment as corporate finance measure. The null hypothesis is rejected: social networks are important drivers of firms'investment decisions. However, the F-Test does not provide any information on how social networks influence corporate finance policy decisions.

3.2 Pair Model

3.2.1 Methodology

The Pair model measures the influence on a firm's corporate policies of the actions of its social neighboring companies. The unit basis of analysis in the Pair model is each pair of two companies. Given 2,101 companies in the sample, there are more than 2 million pairs. For each pair, I measure the strength of the social connection, i.e. the number of individual links that connect the two companies. Two main research questions can be addressed using the Pair model. The first question is whether two companies that are more socially connected have a more similar investment strategy relative to two companies that are not as well socially connected. This question investigates how the level of social connections affects the level of capital expenditure at each point in time (statically). The second question is whether two companies that are more socially connected change their investment over time in a more similar way relative to two companies that are not as well socially connected. This question investigates dynamically how the level of social connections affect the changes in their capital expenditures over time (dynamically).

Both tests require a two-stage econometric model. First, company i's corporate finance policy decision $Policy_{i,t}$ is regressed over the typical control variables $X_{Pi,t}$ relative to the policy decision.[12] The residual $\varepsilon_{i,t}$ of the regression is a measure of the idiosyncratic behavior of company i at time t. Then for each pair of companies i and j, I take the absolute value of the difference in their residual, $|\Delta\varepsilon| = abs(\varepsilon_{i,t} - \varepsilon_{j,t})$. This variable is a proxy for the difference in the corporate finance policy decisions of the two companies. I also compute the absolute value of the first difference over time of the difference in residuals, $|\Delta\Delta\varepsilon| = abs((\varepsilon_{i,t} - \varepsilon_{j,t}) - (\varepsilon_{i,t-1} - \varepsilon_{j,t-1}))$. This variable is a proxy for how the corporate finance policies change over time between the two companies. In the second stage, these two variables, $|\Delta\varepsilon|$ and $|\Delta\Delta\varepsilon|$[13], are regressed over the Strength of the connection $S_{i,j}$ between the two companies[14]. As defined in section 2, the strength of the connection is a measure of the intensity of the social ties existing between the two companies.

1^{st} Stage: $Policy_{i,t} = \alpha_0 + \alpha_1 X_{Pi,t} + \varepsilon_{i,t}$

2^{nd} Stage Comparing Inv. Levels: $abs(\varepsilon_{i,t} - \varepsilon_{j,t}) = \beta_0 + \beta_1 S_{i,j,t} + \beta_2 X_{Ci,j,t} + \eta_{i,j,t}$

2^{nd} Stage Comparing Inv. Changes: $abs((\varepsilon_{i,t} - \varepsilon_{j,t}) - (\varepsilon_{i,t-1} - \varepsilon_{j,t-1})) = \gamma_0 + \gamma_1 S_{i,j,t} + \gamma_2 X_{Ci,j,t} + \delta_{i,j,t}$

[12] For the investment policy, the control variables used in the first stage are size (Total Assets and Total Assets Squared), investment opportunities (Tobin's Q), profitability (Cash Flow), the interaction of size and investment opportunities, and year and industry (Fama French 49 industry code) dummies. Refer to the appendix for a definition of the financial variables.

[13] Each $\varepsilon_{i,t}$ is an estimated value with measurement error. However, because the measurement error is on the dependent variable in the second stage regression, the OLS estimation is unbiased and consistent under regular OLS assumptions (Wooldridge (2002), p.71).

[14] When estimating the second stage equation, I account for serial correlation by allowing for clustering of the error term at both firms i and j level using the double-clustering algorithm from Peterson (2008). In untabulated results available from the author, I find that results are robust to using bootstrapping techniques and clustering at the pair level as alternative corrections for correlation in the residuals.

3.2.2 Results of the Pair Model Comparing Investment Levels

In the Pair Model using the levels of the difference in residuals, I test whether stronger social connections induce more similar investment strategy. Therefore, the Strength coefficient β_1 in the second stage regression should be negative. Table 4 shows the results of the second stage of the model using the aggregate SNI as social network. In column (1) I present the baseline regression including only the Strength variable. The first stage regression already controlled for industry, year, size, investment opportunity and profitability. Therefore the second stage regression does not require further control for those variables. I find a strong and negative effect of the strength of the social connection on the absolute value of the difference in residuals. In column (2), I add three control variables: the number of key executives and directors in both companies, to control for the fact that the larger the board and management group, the more social connections they have, and an industry dummy that takes a value 1 if the pair of companies are in the same industry[15]. Even though I already control for industry effects in the first stage, the industry control in the second stage controls for possible heteroscedasticity in the second moments of the investment variable across industries. Such heteroscedasticity can influence and bias the second stage results. For example, if the idiosyncratic variance of investment differs across industries, then pair of companies in the same industry could drive both the social network variables and the difference in the residuals. Using a similar argument, I also add year dummies to control for idiosyncratic differences in the second moments across years. After controlling for industry, year and board size, the effect of social connections decreases in magnitude, but remains strongly statistically significant.

The central hypothesis of this paper is that social connections are important channels of communication and influence. Information flows more freely and at a lower cost through

[15] I use Fama French 49 industry levels in the entire paper

these networks. A possible alternative explanation could be that the measures of social connections are just a proxy for a specific style of management. Managers that went to Harvard together have a similar background and formation, and therefore will behave and manage their companies more similarly, but with no information exchange. The specification in Column (3) addresses this concern. I define a control variable that measures whether two individuals went to the same school, earned the same professional degree, but graduated not within one year of each other. Similarly I define another control variable that measures whether two individuals worked for the same company as key executives or top managers, but not at the same time. These control variables can be considered a proxy for the management style associated with going to the same school or working in the same company. Column (3) shows that even after controlling for the style variables, the coefficient of the SNI variable is still negative and statistically significant. It is important to point out the economic magnitude of the correlation. An additional social connection between two companies under the current employment measure reduces the difference in the investment level by 0.6% of Property, Plants and Equipment (PP&E).

One possible concern could be that the results are driven by outliers: firms that are unique in their investment behavior, and therefore with no social connections. To control for outliers, I run quantile regressions from the first to the tenth lowest decile. In untabulated regressions available from the authors, I find that the social network coefficient is negative and statistically significant across all the deciles of the absolute value of the difference in residuals.

So far, I have shown that a correlation exists between corporate finance policy decisions and the social network connections. Specifically, companies that are more connected with each other have a more similar investment behavior. A possible identification problem though arises in the empirical analyses performed so far: there could be an omitted variable problem in which a third unobserved variable drives both social networks and corporate finance policies. Companies experience shocks in their investing opportunity sets and dynamically adjust their strategies over time. Consequently, they hire new directors and key executives with specific social connections to match their new strategy. For example, companies in financial distress might hire people with a specific education or past employment skills to turn the firm around, or successful companies with high investment levels and high return on assets might expand their social network because of their success.

Three arguments and a new model suggest there is a causal relationship from social networks to corporate finance policy decisions. First, all the regressors in the equations are lagged one year relative to the dependent variables. Lagging per se does not solve the identification problem, especially when highly persistent variables are used as dependent variables or when companies hire new key executives prior to changes in corporate finance policies. However, it at least eliminates concerns of contemporaneous endogenous effects. Second, the Past Employment and Education connections occurred long before the policy decisions, and therefore it is harder to conjecture a reverse causality story where social connections are driven by successful investments. Third, I use a unique features of the dataset: its longitudinal component. Social networks change over time, and I can track how changes in the network relate to changes in the investment strategy. Column (4) shows the results of the pair-fixed effect regression. Pair dummies absorb any unobserved fixed pair omitted variables by looking at the correlation between a change in the lagged social network parameter and a change in the dependent variable over time for each pair of companies. The results of the fixed effect regressions are consistent with the results of the OLS pooled regressions. The SNI coefficient is still negative and statistically significant.

One alternative , reverse-causality explanation of the results above is that when companies want to change corporate finance policy strategy, they hire people with the appropriate skills and social connections to implement the desired actions. Because this change occurs over time within the same company, firm dummies do not absorb such variation. An exogenous shock to the social network matrix is needed as instrumental variable to test the direction of causality between social connections and corporate finance policies. In corporate finance, identifying causal effects is challenging because of the absence of real exogenous shocks. Social networks shocks are less rare. A clearly exogenous instrumental variable to the social network connections is the death of an individual. When a director dies the social ties he had with other individuals in the network cease to exist, therefore altering exogenously the social connections between companies. It is hard to believe that these events are correlated with the error terms or the dependent variable of our models. In the sample period considered, there have been 355 deceased directors.

Columns (5) and (6) shows the results of the instrumental variable regressions. First, I select all the pairs of companies that at some point in time were socially connected through an individual that passed away, weakening the connection. The tested hypothesis is that two companies behave less similarly when an individual who connects them dies. The first stage of the regression uses as excluded instrument a dummy variable that counts the number individuals with ties with both companies who have died within 1 year of leaving the company, up to the current fiscal year. The excluded instrument f-statistic is significant in all specifications. In the second stage, the absolute value of the difference in residuals is regressed over the endogenous strength of the SNI social connection variable. Column (6) shows that the results are robust and to exogenous changes in the levels of social connections. Overall, the results of the instrumental variable regression suggest that changes in the social connection have a causal effect on changes in the investment policy decision.

In Table 5, I investigate which of the social networks components, among the Current Employment, Past Employment, Education and Other Activities has more influence in the investment policy of a company. Column (1) to (4) show that all network have a negative and statistically significant coefficient. Comparing the beta coefficients provide us an indication of the relative importance of the networks. The OA network coefficient is twice as large as the other networks coefficients. Other Activities network seems therefore to play a larger role than other networks in influencing investment policies[16].

3.2.3 Results of the Pair Model Comparing Investment Changes

In the previous section I used the level of difference in residuals between each pair of companies to draw conclusions on how social networks affect investments at each point in time. The evolution of investment over time is also affected by social connections. Two companies that are more socially connected are more prone to exchange information and therefore change their investment strategy over time in a more similar way. The Pair model comparing investment changes tests whether the first difference of the difference in residuals is driven by social connections. Table 6 presents the results of the Pair model using the difference in difference as dependent variable. The results are consistent with the findings of the Pair model comparing investment levels. In column (1) I find that two companies that are more connected with each other change their investment policies more similarly over time than two companies that are not as equally connected. Column (2) shows that even after controlling for possible heteroscedasticity in industry, year and board size in the first stage regression, the SNI coefficient is negative and statistically significant.

Possible alternative explanations that results are driven by specific styles of management are controlled for in Column (3). Specification in column (4) is particularly

[16]In untabulated results, regressions using pair fixed effects on the individual components shows that the OA network coefficient is strong and significant even after controlling for pair-heterogeneity effects. Results of the IV regressions of single network components (CE, PE, ED, OA) variables are also available from the author and not reported in the paper.

interesting, because it controls for pair-level heterogeneity. The SNI coefficient is still negative and statistically significant. It means that for example when the social connections between two companies increase, their investment strategy over time becomes more similar. Finally, I use deaths of directors as exogenous shock to the social network to establish a direction of causality between social networks and investment strategy. Columns (5) and (6) show the results of the instrumental variable specification. Similar to what I found in the Pair model comparing investment levels, I find that when a director that connects two companies dies, the investment strategies of those companies becomes less similar over time.

The network components (CE, PE, ED, OA) are also studied individually in Table 7. Columns (1) to (4) confirm what I found in the Pair model comparing investment levels. All network components are important determinants of a company's investment strategy, and the OA network has the greatest effect on the investment strategy[17].

3.3 Centrality Model

3.3.1 Methodology

The Pair Model showed that for each pair of companies, a causal, positive and statistically significant relationship exists between the strength of the connection and the similarity of their investment behavior. The results are particularly interesting because they look at the local connections between each pair of companies. However, the Pair model does not consider whether and how companies are influenced by their global position in the network. The Centrality Model addresses this issue, using the centrality measures described in section 2.

[17] In untabulated results, I find that the results of the OA network are robust even after controlling for pair-heterogeneity using a pair fixed effect regression.

The Centrality Model tests the hypothesis that companies centrally positioned in the network have corporate finance policy decisions that are less idiosyncratic than companies on the outskirts of the network. The literature on information diffusion in social networks is large and multidisciplinary. For example, Buskens (2002) introduces a stochastic model of information diffusion that predicts the transmission of information depending on the position of the node in the network. Central players are more exposed to word-of-mouth and private information; they can compare their decisions with the ones of their social peers. On the contrary, companies whose members are not socially connected do not have a reference with whom to compare their decisions, and therefore they behave in a more unique fashion.

Testing the centrality hypothesis requires a two-stage econometric model similar to the Pair Model. First, company i's corporate finance policy decision $Policy_{i,t}$ is regressed over the typical control variables $X_{Pi,t}$ relative to the policy decision, as in the Pair model. The absolute value of the residual $\varepsilon_{i,t}$ of the regression is a measure of the idiosyncratic behavior of company i at time t relative to all other firms in the network. In the second stage, the absolute value of the residual $abs(\varepsilon_{i,t})$ is regressed over the centrality measure $C_{i,t}$ and control variables $X_{Ci,t}$. The second stage regression tests whether a correlation exists between the centrality measure and a firm's idiosyncratic behavior.[18]

$$1^{st} \text{ Stage: } Policy_{i,t} = \alpha_0 + \alpha_1 X_{Pi,t} + \varepsilon_{i,t}$$

$$2^{nd} \text{ Stage: } abs(\varepsilon_{i,t}) = \beta_0 + \beta_1 C_{i,t} + \beta_2 X_{Ci,t} + \eta_{i,t}$$

Degree, betweenness, and closeness are the centrality measures used in the second stage regression. These measures are used as regressors both individually, as well as together as

[18]When estimating the second stage equation, I account for serial correlation by allowing for clustering of the error term at both the firm and year levels using the double-clustering algorithm from Peterson (2008).

first component in a principal component analysis. As explained in Section 2, the degree and betweenness measures are more sensitive to information flow, whereas closeness is more related to influence. Therefore, according to the centrality hypothesis, the degree and betweenness measures are expected to come in more significantly in the regression than the closeness measure.

The prediction of the centrality hypothesis is that the more central the company is in the network, the less idiosyncratic its behavior. Therefore a negative coefficient β_1 in the second stage regression is expected.

3.3.2 Results of the Centrality model

Tables 8 and 9 show the results of the second stage regression of the centrality model for the investment policy decision[19]. Table 8 shows the results of regressing the absolute value of the residuals over several centrality measures for the SNI network. Specifications (1) to (3) include only the three centrality measures: overall, I find strong evidence that companies that are more centrally positioned in the network have less idiosyncratic investment behavior. Since degree, betweenness and closeness are all proxy for the position of a firm in the social network, I aggregate the information on centrality using principal component analysis. The first principal component, that loads positively on all variables, explain 78% of the variance[20]. Column (4) shows that the coefficient of the first component is negative and statistically significant. In column (5) I control for heteroscedasticity of the second moments adding year and industry fixed effects, as well as board size controls. I find that adding such control variables reduces the magnitude of the coefficient, but it remains strongly statistically significant. As in the Pair model, style effects, such as having a similar background of

[19] Details of the Investment first stage regression can be found in Table 12 in the appendix. Detailed results of the principal component analysis are available from the author and not reported in the paper.

[20] Results of the principal component analysis are untabulated and available from the author.

experiences, can be controlled for by adding PE and ED control variables of connections that do not occur in the same years. Results of the column (6) specification confirm that flow of information, and not similarity of styles, correlates with similarity in investment policies[21]. Finally, column (7) specification runs a panel regression adding firm-fixed effects: even after controlling for firm-heterogeneity, the centrality coefficient remains negative and significant. The results of the fixed effect model are particularly interesting: when companies change their position in the social network, there is a consequent change in their investment policy. The centrality results are not only statistically but also economically significant. The beta coefficient of the degree measure is about 6%. That means that a one standard deviation change in the position in the network corresponds to a 6% standard deviation decrease in its idiosyncratic investment. The direction of causality has already been shown in the Pair model using deaths of directors and key executives as exogenous shocks to the network. The death of an individual that connects two companies is clearly a negative shock to the strength of the social connection between the two companies. Unfortunately the same approach can not be used in the Centrality model. Here, the death of an individual has a more ambiguous effect on the position of the company in the network. If the person that replaces the deceased person is more connected, than the shock would be positive, otherwise negative. The lack of a clear direction of causality between the death of an individual and its effect on the network makes the instrumental variable approach unfit for the analysis.

Table 9 shows the results of the Centrality Model for different types of social networks. Consistent with the findings of the Pair model, the OLS pooled regressions (columns (1) to (4)) show that all types of network connections influence the investment policy of a company. The beta coefficients suggest that the past employment and the other activities networks

[21] Quantile regressions, untabulated and available from the authors, shows that the coefficient is negative and significant at every decile

affect the investment policies more than the current and the education networks[22].

3.4 Value Implications

The previous sections have established that a causal relationship exists between social networks and investment policy decisions. As shown in the centrality model, the position in the social network is an important driver that influences a firm's investment. If a company is in a central position in the network, it is exposed to a higher flow of word-of-mouth information and therefore will take decisions that are less idiosyncratic. A natural extension of this argument is to ask whether being in a central position leads not only to less idiosyncratic but also better decisions. Centrally-located companies that are exposed to a wider set of information should exploit such competitive advantage and have higher economic performance than companies that are not so socially connected. The Performance Model thus investigates the correlation between the return on assets and the centrality measure of socially connected companies.

Table 10 illustrates the main results of the OLS pooled and panel regressions of return on assets over the degree centrality measures and a series of controls.[23] As argued in previous sections, the degree measure is the one that best captures the information flow that a company is exposed to from its nearest neighbors. First, I find in column (1) a positive and significant correlation between economic performance and the degree measure of social network centrality. In columns (2) and (3)) I find that after controlling for year, industry and size, the centrality measure remains positive and statistically significant. Even after controlling for PE and ED connections developed not at the same time (column (4)), and

[22]In untabulated results, I find that the PE and OA network results are also robust to firm-fixed effect specifications.

[23]As in previous models, when estimating the regression coefficients, I account for serial correlation by allowing for clustering of the error term at both firms and year level using the double-clustering algorithm from Peterson (2008).

therefore controlling for any "style" characteristics, the coefficient is positive and significant. The results are economically significant: looking at the beta coefficient of the degree measure in column (5), a one standard deviation increase in the degree centrality measure is correlated with a 7% standard deviation increase in the return on assets. Finally, the results hold also in a firm fixed effect specification, as shown in column (6).

Finally, Table 11 shows the effect of the position in each component of the SNI network (CE, PE, ED, OA) relative to the firm performance. Similar to what found in previous sections, the coefficient of CE, ED and OA networks are positive and significant[24]. The PE coefficient, albeit positive, is not statistically significant.

4 Conclusion

Reliance on decision externalities is widespread in society, and arise from constrains on our ability to process or obtain costly information. This paper provides evidence that decision externalities play an important role also in companies. Managers rely on their social network when making corporate finance policy decisions. Using biographical information of key executives and directors of the board, I create a matrix of social ties from current employment, past employment, education and other activities. I demonstrate that these social connections influence the way companies make corporate finance decisions. In particular, companies are influenced in their policy decision making process by their nearest social neighbors. The more social connections two companies shares together, the more similar is their investment behavior and the more similar they change their investment strategy. I address concerns for endogeneity problems and direction of causality using the deaths of directors as an exogenous shock to the social network parameters. Using

[24]In untabulated results, the CE and OA networks results are robust also to a firm-fixed effect specification

an instrumental variable regression, I find that the results are robust to omitted variable problems. Furthermore, companies that are positioned more centrally in the network invest in a less idiosyncratic way. Finally, I draw some value implications on the effect of social networks on firm performance: Companies that are more central in the social networks have greater economic performance measured as return on assets.

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Figure 1: Social Network 2005 Current Employment

The figure below has been drawn using the Pajek software for large social networks. I used a Kamada-Kawai energy algorithm with random starting positions to draw the network. The network shows all the connections between companies whose individuals share a professional connection because they sit on the board of directors or on the executive board in the same company

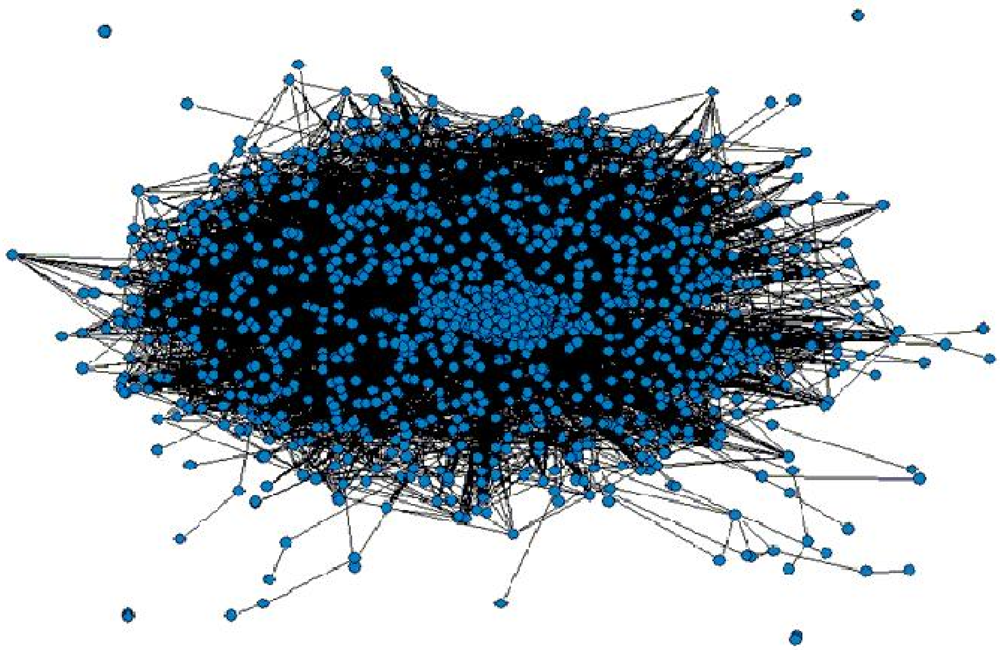

Table 1: Summary Statistics of Social Network Variables

The table shows the summary statistics of the social networks among the companies in the sample. The edges are the number of non-zero ties between companies. The Average Degree is the average number of valued links for each company divided by the number of companies in the network. The Average Betweenness is the average number of shortest paths linking every dyad in the network that pass through the company node. The Average Closeness is the average distance between a particular node and every other node in the network. Diameter is the maximum number of steps that are needed to connect each node with every other node in the network. The summary statistics for each type and level of connections are averaged over the years from 2000 to 2006.

	SNI	**CE**	**PE**	**ED**	**OA**
N of Companies	2,101	2,101	2,101	2,101	2,101
N. of Edges	576,117	58,513	149,594	43,482	468,707
Avg. Degree	0.366	0.029	0.070	0.022	0.256
Avg. Between	1420.1	1722.7	1910.5	2100.0	1421.0
Avg. Closeness	0.2707	0.1213	0.1902	0.1030	0.2589
Diameter	4.29	7.86	8.00	8.71	4.43

Table 2: Summary Statistics of Financial Variables

The table shows the summary statistics of the financial variables for the companies in the sample. Please refer to the appendix for the definition of the financial variables.

Variable	Mean	Std. Dev.	Min.	Max.	N
Investment	0.322	0.314	0.017	2.619	16,237
Leverage (book)	0.334	0.26	0	1.166	20,317
Cash Flow	0.847	1.841	-11.413	12.888	16,997
Total Assets	11,463	65,182	0	2,187,631	20,394
Sales	4,270	13,937	-4,234	375,376	20,387
Market-to-Book Ratio	2.071	2.443	0.298	105.09	19,903
Tangibility	0.251	0.23	0	0.97	19,482
Return on Assets	0.047	0.107	-0.809	0.371	18,180
R&D Ratio	0.077	0.237	0	16.093	10,028
SG&A Ratio	0.315	1.577	-0.053	158.95	16,448
Cash Reserves Ratio	0.149	0.187	0	0.987	20,391
Dividend Payout Ratio	0.083	0.846	-45	76	19,492

Table 3: Pair Model - F-Test

The table shows the results of the F-Test for the Same-Pair Model. See text for a description of the model. I run an F-Test to assess whether the addition of the social connection variables increase the explanatory power of the model. The dependent variable is investment. The control variables are lagged Total Assets (log), lagged Total Assets squared (log), lagged Tobin's Q, Cash Flow, and the interaction of lagged Total Assets and Tobin's q, and time and industry dummies. See the appendix for the definition of the variables. The errors are clustered at the firm level. The social connection variable is the strength of the connection between two companies. Reported are the F-Value, the p-value and the number of observations.

	SNI	CE	PE	ED	OA
F-Value	1.507	1.340	1.533	1.622	1.456
P-Value	0.000	0.000	0.000	0.000	0.000
N. of Obs.	9728	9728	9728	9728	9728

Table 4: Pair Model Comparing Investment Levels

Dependent Variable: Absolute value of the difference in residuals of the First Stage Regression of Investment Policy between each pair of companies in the sample. The table shows the results of the second stage of the Pair Model. See text for a description of the model. Available from the author and not reported in the paper are the results of the first stage regression. Strength SNI is the total number of social ties in the SNI network that exist between individuals in the two companies. Sum N. Exec & Direc. is the sum of all directors on the board and key executives on the two companies. Same Industry Dummy is a variable that takes the value 1 if the two companies are in the same FF49 industry. Strength PE (ED) - Not Same Year is a measure of management style ant counts the number of non-overlapping Past Employment (Education) connections that exist between individuals in the two companies. Deceased Dummy is the excluded instrument and it counts the number individuals with ties with both companies who have died within 1 year of leaving the board, up to the current fiscal year. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. The last two columns show the results of the 2SLS-IV regression. Standard errors in column (1) to (4) are corrected for clustering of the error term at both firms level using the double-clustering algorithm from Peterson (2008). Standard errors in column (5) and (6) are corrected for clustering of the error therm at the pair level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)	(1^{st} St. IV)	(2^{nd} St. IV)
Strength SNI	-0.02281***	-0.00642***	-0.00709***	-0.00320***		-0.01737***
	-0.08730	-0.02699	-0.02980	-0.01345		-0.22895
	(-16.22)	(-5.82)	(-6.33)	(-3.55)		(-3.46)
Sum N. Exec. & Direc.		-0.00859***	-0.00863***	0.00043	0.06386***	0.00254***
		-0.17609	-0.17698	0.00878	0.11522	0.06039
		(-14.85)	(-14.91)	(0.44)	(20.78)	(4.86)
Same Industry Dummy		0.00535**	0.00527*	-0.51441	0.00000	
		0.00474	0.00466	-0.45491	0.00000	
		(1.97)	(1.94)	(-0.00)	.	
Strength PE - Not Same Year			0.00260	-0.00021	0.84386***	0.01052**
			0.00466	-0.00037	0.34007	0.05587
			(1.47)	(-0.19)	(42.85)	(2.32)
Strength ED - Not Same Year			0.00120	-0.00145	0.12085***	0.00691***
			0.00419	-0.00506	0.04549	0.03428
			(0.58)	(-0.55)	(9.30)	(4.19)
Death Dummy					-0.42538***	
					-0.07993	
					(-24.71)	
Year FE	No	Yes	Yes	Yes	Yes	Yes
Pair FE	No	No	No	Yes	Yes	Yes
r2	0.008	0.038	0.038	0.536	0.237	0.004
N	5,341,676	4,813,974	4,813,974	4,813,974	52,067	51,193

Table 5: Pair Model Comparing Investment Levels - by Network Component

Dependent Variable: Absolute value of the difference in residuals of the First Stage Regression of Investment Policy between each pair of companies in the sample. The table shows the results of the second stage of the Pair Model. See text for a description of the model. Available from the author and not reported in the paper are the results of the first stage regression. Strength CE, PE, ED and OA are the total number of social ties in the CE, PE, ED and OA networks that exist between individuals in the two companies. Sum N. Exec & Direc. is the sum of all directors on the board and key executives on the two companies. Same Industry Dummy is a variable that takes the value 1 if the two companies are in the same FF49 industry. Strength PE (ED) - Not Same Year is a measure of management style ant counts the number of non-overlapping Past Employment (Education) connections that exist between individuals in the two companies. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at both firms level using the double-clustering algorithm from Peterson (2008). *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)
Strength CE	-0.01335***			
	-0.01287			
	(-6.96)			
Strength PE		-0.01041***		
		-0.01471		
		(-6.77)		
Strength ED			-0.01922***	
			-0.01217	
			(-5.81)	
Strength OA				-0.00829***
				-0.02363
				(-4.83)
Sum N. Exec. & Direc.	-0.00895***	-0.00889***	-0.00903***	-0.00865***
	-0.18354	-0.18232	-0.18500	-0.17724
	(-15.76)	(-15.56)	(-15.94)	(-15.01)
Same Industry Dummy	0.00428	0.00467*	0.00407	0.00519*
	0.00379	0.00413	0.00360	0.00459
	(1.57)	(1.71)	(1.50)	(1.91)
Strength PE - Not Same Year		-0.00059		
		-0.00106		
		(-0.30)		
Strength ED - Not Same Year			0.00096	
			0.00336	
			(0.47)	
Year FE	Yes	Yes	Yes	Yes
r2	0.038	0.038	0.038	0.038
N	4,813,974	4,813,974	4,813,974	4,813,974

Table 6: Pair Model Comparing Investment Changes

Dependent Variable: Absolute value of the difference-in-difference of the residuals of the First Stage regression of Investment Policy between each pair of companies in the sample. The table shows the results of the second stage of the Pair Model. See text for a description of the model. Available from the author and not reported in the paper are the results of the first stage regression. Strength SNI is the total number of social ties in the SNI network that exist between individuals in the two companies. Sum N. Exec & Direc. is the sum of all directors on the board and key executives on the two companies. Same Industry Dummy is a variable that takes the value 1 if the two companies are in the same FF49 industry. Strength PE (ED) - Not Same Year is a measure of management style ant counts the number of non-overlapping Past Employment (Education) connections that exist between individuals in the two companies. Deceased Dummy is the excluded instrument and it counts the number individuals with ties with both companies who have died within 1 year of leaving the board, up to the current fiscal year. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. The last two columns show the results of the 2SLS-IV regression. Standard errors in column (1) to (4) are corrected for clustering of the error term at both firms level using the double-clustering algorithm from Peterson (2008). Standard errors in column (5) and (6) are corrected for clustering of the error therm at the pair level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)	(1^{st} St. IV)	(2^{nd} St. IV)
Strength SNI	-0.02679***	-0.00873***	-0.00950***	-0.00330**		-0.02594***
	-0.09209	-0.03000	-0.03266	-0.01134		-0.28460
	(-16.44)	(-6.76)	(-7.11)	(-2.17)		(-3.72)
Sum N. Exec. & Direc.		-0.01103***	-0.01104***	-0.00130	0.06386***	0.00206***
		-0.18501	-0.18515	-0.02175	0.11522	0.04075
		(-14.36)	(-14.60)	(-1.02)	(20.78)	(3.03)
Same Industry Dummy		0.01130***	0.01117***	-1.96461	0.00000	
		0.00818	0.00809	-1.42178	0.00000	
		(3.16)	(3.13)	(-0.00)	.	
Strength PE - Not Same Year			0.00363	-0.00184	0.84386***	0.01883***
			0.00532	-0.00270	0.34007	0.08324
			(1.56)	(-1.44)	(42.85)	(3.00)
Strength ED - Not Same Year			-0.00030	-0.00492	0.12085***	0.00647***
			-0.00085	-0.01404	0.04549	0.02673
			(-0.10)	(-1.37)	(9.30)	(3.03)
Death Dummy					-0.42538***	
					-0.07993	
					(-24.71)	
Year FE	No	Yes	Yes	Yes	Yes	Yes
Pair FE	No	No	No	Yes	Yes	Yes
r2	0.008	0.043	0.043	0.564	0.237	0.007
N	4,813,974	4,813,974	4,813,974	4,813,974	52,067	51,193

Table 7: Pair Model Comparing Investment Changes - by Network Component

Dependent Variable: Absolute value of the difference-in-difference of the residuals of the First Stage regression of Investment Policy between each pair of companies in the sample. The table shows the results of the second stage of the Pair Model. See text for a description of the model. Available from the author and not reported in the paper are the results of the first stage regression. Strength CE, PE, ED and OA are the total number of social ties in the CE, PE, ED and OA networks that exist between individuals in the two companies. Sum N. Exec & Direc. is the sum of all directors on the board and key executives on the two companies. Same Industry Dummy is a variable that takes the value 1 if the two companies are in the same FF49 industry. Strength PE (ED) - Not Same Year is a measure of management style ant counts the number of non-overlapping Past Employment (Education) connections that exist between individuals in the two companies. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at both firms level using the double-clustering algorithm from Peterson (2008). *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)
Strength CE	-0.01817***			
	-0.01434			
	(-7.65)			
Strength PE		-0.01282***		
		-0.01483		
		(-6.20)		
Strength ED			-0.01833***	
			-0.00950	
			(-3.72)	
Strength OA				-0.01186***
				-0.02768
				(-6.09)
Sum N. Exec. & Direc.	-0.01152***	-0.01145***	-0.01157***	-0.01108***
	-0.19330	-0.19206	-0.19413	-0.18581
	(-15.31)	(-15.14)	(-15.71)	(-14.45)
Same Industry Dummy	0.00984***	0.01035***	0.00959***	0.01115***
	0.00712	0.00749	0.00694	0.00807
	(2.74)	(2.88)	(2.67)	(3.13)
Strength PE - Not Same Year		-0.00134		
		-0.00196		
		(-0.51)		
Strength ED - Not Same Year			-0.00079	
			-0.00224	
			(-0.26)	
Year FE	Yes	Yes	Yes	Yes
r2	0.042	0.042	0.042	0.042
N	4,813,974	4,813,974	4,813,974	4,813,974

Table 8: Centrality Model

Dependent Variable: Absolute Value of the residual of the First Stage Regression of Investment Policy. The table shows the results of the second stage of the Centrality Model. See text for a description of the model. The results of the first stage regression and the Principal Component Analysis are reported in appendix. SNI-Degree is the number of valued links for each company divided by the number of companies in the SNI network. SNI-Between is the average number of shortest paths linking every dyad in the SNI network that pass through the company node. SNI-Close is the average distance between a particular node and every other node in the SNI network. SNI- Princ. Comp. is the first component of the Principal Component Analysis performed on Degree, Beween and Close. N. Exec & Direc. is the number of Directors on the Board and Key Executives on the top management group of each company. PE (ED) - Not Same Year is the Principal component of the PE (ED) networks where the Past Employment (Education) connections do not overlap in time. Industries are defines as Fama-French 49 industry groups. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SNI - Degree	-0.09664***						
	-0.19359						
	(-13.87)						
SNI - Between		-0.00002***					
		-0.17217					
		(-12.94)					
SNI - Close			-0.77888***				
			-0.15893				
			(-8.99)				
SNI - Princ. Comp.				-0.02423***	-0.01083***	-0.01240***	-0.00898**
				-0.19645	-0.08776	-0.10051	-0.07281
				(-14.19)	(-5.60)	(-4.64)	(-2.00)
N. Exec. & Direc.					-0.00646***	-0.00666***	0.00050
					-0.11976	-0.12335	0.00927
					(-7.14)	(-6.98)	(0.37)
PE - Not Same Year						0.00181	-0.00117
						0.01503	-0.00971
						(0.68)	(-0.34)
ED - Not Same Year						0.00109	0.00099
						0.00923	0.00841
						(0.74)	(0.53)
Year FE	No	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes	No
Firm FE	No	No	No	No	No	No	Yes
r2	0.037	0.030	0.025	0.039	0.133	0.133	0.513
N	9,380	9,380	9,380	9,380	9,370	9,370	9,370

Table 9: Centrality Model - by Network Component

Dependent Variable: Absolute Value of the residual of the First Stage Regression of Investment Policy. The table shows the results of the second stage of the Centrality Model. See text for a description of the model. The results of the first stage regression and the Principal Component Analysis are reported in appendix. CE, PE, ED, OA - Princ. Comp. variables are the first component of the Principal Component Analysis performed on Degree, Beween and Close for each CE, PE, ED and OA network. N. Exec & Direc. is the number of Directors on the Board and Key Executives on the top management group of each company. PE (ED) - Not Same Year is the Principal component of the PE (ED) networks where the Past Employment (Education) connections do not overlap in time. Industries are defines as Fama-French 49 industry groups. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)
CE - Princ. Comp.	-0.00806***			
	-0.06468			
	(-5.06)			
PE - Princ. Comp.		-0.01336***		
		-0.11048		
		(-3.84)		
ED - Princ. Comp.			-0.00476***	
			-0.03718	
			(-2.88)	
OA - Princ. Comp.				-0.00999***
				-0.08141
				(-5.01)
N. Exec. & Direc.	-0.00754***	-0.00728***	-0.00890***	-0.00677***
	-0.13979	-0.13496	-0.16488	-0.12545
	(-8.71)	(-7.95)	(-10.85)	(-7.52)
PE - Not Same Year		0.00489		
		0.04064		
		(1.30)		
ED - Not Same Year			0.00084	
			0.00712	
			(0.57)	
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
r2	0.131	0.132	0.130	0.132
N	9,370	9,370	9,370	9,370

Table 10: Performance Model

Dependent Variable: Return on Assets. The table shows the results of the Performance Model. See text for a description of the model and the appendix for a description of the financial variables used in the model. SNI-Degree is the number of valued links for each company divided by the number of companies in the SNI network. PE (ED) - Not Same Year is the degree of the PE (ED) networks where the Past Employment (Education) connections do not overlap in time. Industries are defines as Fama-French 49 industry groups. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. Standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)	(5)
SNI - Degree	0.03130***	0.03589***	0.02739***	0.02963***	0.02637**
	0.12100	0.13872	0.10568	0.11432	0.10192
	(6.61)	(7.49)	(4.78)	(3.61)	(2.41)
Total Assets (log)	0.02562***	0.02667***	0.02088***	0.02186***	-0.01817
	0.50696	0.52767	0.41152	0.43103	-0.35948
	(4.15)	(4.31)	(3.35)	(3.48)	(-1.05)
Total Assets Square (log)	-0.00204***	-0.00214***	-0.00163***	-0.00168***	-0.00247**
	-0.65003	-0.68246	-0.51551	-0.53294	-0.78628
	(-5.81)	(-6.09)	(-4.58)	(-4.70)	(-2.21)
PE - Not Same Year				-0.00138	-0.00322
				-0.00167	-0.00392
				(-0.06)	(-0.12)
ED - Not Same Year				-0.00734**	-0.00999**
				-0.03273	-0.04452
				(-2.14)	(-2.53)
Year FE	No	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	No
Firm FE	No	No	No	No	Yes
r2	0.018	0.032	0.088	0.089	0.671
N	10,553	10,553	10,487	10,487	10,553

Table 11: Performance Model - by Network Component

Dependent Variable: Return on Assets. The table shows the results of the Performance Model. See text for a description of the model and the appendix for a description of the financial variables used in the model. CE, PE, ED and OA-Degree is the number of valued links for each company divided by the number of companies in the CE, PE, ED and OA network respectively. PE (ED) - Not Same Year is the degree of the PE (ED) networks where the Past Employment (Education) connections do not overlap in time. Industries are defines as Fama-French 49 industry groups. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. All standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included. Reported are the regular and standardized (beta) coefficients and the t-statistics in parentheses. Standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively. Constant included.

	(1)	(2)	(3)	(4)
CE - Princ. Comp.	0.21913***			
	0.09213			
	(5.16)			
PE - Princ. Comp.		0.04810		
		0.03882		
		(1.11)		
ED - Princ. Comp.			0.13310***	
			0.04516	
			(2.73)	
OA - Princ. Comp.				0.03647***
				0.09858
				(4.63)
Total Assets (log)	0.02086***	0.01986***	0.01898***	0.02061***
	0.41120	0.39157	0.37422	0.40629
	(3.36)	(3.19)	(3.01)	(3.30)
Total Assets Square (log)	-0.00157***	-0.00148***	-0.00128***	-0.00158***
	-0.49668	-0.46854	-0.40577	-0.50175
	(-4.47)	(-4.19)	(-3.59)	(-4.45)
PE - Not Same Year		0.03125		
		0.03785		
		(1.04)		
ED - Not Same Year			-0.00834**	
			-0.03722	
			(-2.25)	
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
r2	0.088	0.086	0.086	0.088
N	10,487	10,487	10,487	10,487

5 Appendix

5.1 Variable Definitions in the Descriptive Statistics

Most of the definitions follow the measures used in Fama and French (2002) and are considered standard in the literature. Data are available from Compustat and CRSP databases over the period January 1997 - June 2008. The Compustat data refer to the end of the fiscal year prior to the announcement of the dividend change. The item in parenthesis refers to the corresponding item in the Fundamentals Annual Compustat North America.

Cash Flow is the ratio (Income Before Extraordinary Items (ib) + Depreciation and Amortization (dp)) / lagged Total Assets (at), trimmed at the [1,99] quantile.

Cash Reserves Ratio is the ratio Cash and Short-Term Investments (che) / Total Assets

Dividend Payout Ratio is the ratio (Preferred Dividends (dvp) + Common Ordinary Dividends (dvc)) / Operating Income Before Depreciation (oibdp)

Investment is the ratio between Capital Expenditure (capx) and lagged Property, Plant & Equipment (PP&E) (ppe), trimmed at the [1,99] quantile.

Leverage (Book) is the ratio (Debt in Current Liabilities (dlc) + Long-Term Debt (dltt)) / (Debt in Current Liabilities (dlc) + Long-Term Debt (dltt)) + Common/Ordinary Equity (ceq))

Leverage (Market) is the ratio (Debt in Current Liabilities (dlc) + Long-Term Debt (dltt)) / (Debt in Current Liabilities (dlc) + Long-Term Debt (dltt)) + Common Shares Outstanding (csho) * Price Close at the end of Fiscal (prcc_f)

Market-to-Book is the ratio (Total Assets (at) - Stockholders' Equity (seq) + Common Shares Outstanding (csho) * Price Close at the end of Fiscal (prcc_f)) / Total Assets (at)

R&D Ratio is the ratio Research and Development Expense (xrd) / lagged Total Assets (at)

Return on Assets is the ratio Income Before Extraordinary Items (ib) / lagged Total Assets (at, trimmed at the [1,99] quantile

Sales is the Net Sales Turnover (sale)

SG&A Ratio is the ratio Selling, General and Administrative Expense (xsga) / lagged Total Assets (at)

Tangibility is the ratio (Net Property, Plant and Equipment (ppent) / Total Assets (at)

Table 12: First Stage Regressions

The table shows the results of the first stage of the Models in the paper. See text for a description of the models and the appendix for the definition of the financial variables. The models include industry (Fama French 49 industry classification) and year dummies. Reported are the OLS coefficients and the t-statistics in parentheses. Standard errors are corrected for clustering of the error term at the firm level. *, **, indicates significance at the 10%, 5% and 1% level, respectively.

	(1)
Total Assets (log)	-0.05783***
	(-4.87)
Total Assets Square (log)	0.00247***
	(3.55)
Tobin's Q	0.06348***
	(4.93)
Cash Flow	0.03700***
	(11.37)
Tobin's Q * Total Assets	-0.00375*
	(-1.88)
Constant	0.44412***
	(8.21)
Year FE	Yes
Industry FE	Yes
r2	0.325
N	13,710

Table 13: Principal Component Analysis of the Three Centrality Measures

The table shows the results of the principal component analysis of the centrality measures degree, betweenness and closeness. SNI-Degree is the number of valued links for each company divided by the number of companies in the SNI network. SNI-Between is the average number of shortest paths linking every dyad in the SNI network that pass through the company node. SNI-Close is the average distance between a particular node and every other node in the SNI network. *, **, indicates significance at the 10%, 5% and 1% level, respectively.

Principal components/correlation

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.08851	1.55145	0.6962	0.6962
Comp2	.537056	.162621	0.1790	0.8752
Comp3	.374435	.	0.1248	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Unexplained
Degree - SNI	0.5650	-0.6944	0.4456	0
Betweenness - SNI	0.6041	-0.0197	-0.7967	0
Closeness - SNI	0.5620	0.7193	0.4084	0