CEO connectedness and the cost of capital

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Abstract

A larger CEO network can reduce cost of capital by reducing information asymmetry between the firm and outsiders, and increase trust between the firm and other firms or stakeholders. Alternatively, a larger network can increase cost of capital because the higher CEO connectedness reduces the costs to the CEO of being fired, which encourages greater agency problems and higher risk decisions. We find a positive relation between CEO's connectedness and the firm's cost of equity, suggesting that the costs, on average, outweigh the benefits. The positive relation between CEO connections and cost of capital is attenuated for firms with high information asymmetry, consistent with the beneficial effects of improved information flow mitigating some of the adverse effects from agency costs and risk-taking. We use multiple ways to handle endogeneity and reverse causality problems, and our results are generally robust.

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1. Introduction

The cost of capital is a measure that reflects investors' perceptions of risk and return from investing in the company (Francis, LaFond, Olsson, and Schipper, 2004). It plays a critical role when a firm makes its financing and investment decisions and affects all aspects of firm decision-making. In this paper, we examine the empirical relation between a firm's implied cost of equity and the size of its CEO's external social network formed through his prior employment, education, and other social activities outside the boundaries of the firm.[1] The CEO of a Standard and Poor's 1500 firm averages 135 such external social network connections. We explore three non-mutually exclusive channels, namely information asymmetry, agency, and risk-taking, by which CEO connections can affect the cost of equity.

Cohen, Frazzini, and Malloy (2008, 2010) suggest that social network ties between the CEO and the investment community serve as conduits for information flow and resource exchange. The greater information flow reduces information asymmetry between the firm and outside investors and can affect the cost of equity in various ways. The lower information asymmetry reduces monitoring costs by outsiders, which reduces the firm's cost of equity. Papers focusing on managerial ties specifically to financiers generally find support for this information asymmetry channel. For example, Engelberg, Gao, and Parsons (2012) find that social ties to banks reduce the borrowing rate in U.S. firms. Ferris, Javakhadze, and Rajkovic (2017b) find that firm connections to financiers, defined as investment companies, private equity, specialty and other finance companies or banks, lower the cost of equity capital for a sample of international firms, especially in underdeveloped financial markets. Furthermore, social connections foster trust between

[1] In the rest of this paper, we use the terms implied cost of capital, cost of capital, and cost of equity interchangeably, and we use the terms CEO connections, connectedness, external network, and social network interchangeably..

transacting parties; CEOs with better connections can tap onto their vast networks to build long-lasting, stable relationships with firm stakeholders such as customers and suppliers, which leads to more stable operations and hence lower cost of equity (Larcker, So, and Wang, 2013). These benefits from lowering information asymmetry via reduction in monitoring costs or increased trust with important stakeholders lower the firm's cost of capital.

A large number of previous research studies suggests several channels for how more CEO connections can exacerbate managerial agency problems and increase risk-taking behaviors. Fracassi and Tate (2012) and Hwang and Kim (2009) find evidence that CEO personal connections to his own board of directors undermine the effectiveness of director monitoring and corporate governance, which increases managerial agency problems in the firm. Fahlenbrach, Kim, and Low (2018) suggest that well-connected CEOs have undue influence over their board of directors because they possess important network contacts that can help advance the careers of directors. Furthermore, well-connected CEOs face less discipline from the threat of firing as they can often fall back on their social network to find another job (see e.g., Liu, 2014). Consistent with better-connected CEOs increasing agency problems, El-Khatib, Fogel, and Jandik (2015) document that merger and acquisition deals initiated by highly-connected CEOs carry greater value loss to both the acquirer and the combined entity than deals initiated by less-connected CEOs. Furthermore, Kirchmaier and Stathopoulos (2008) find that CEOs with large social network have worse firm performance.

Firms with higher agency problems need not necessarily experience a higher cost of equity. Cost of equity can increase because outside investors of firms with larger agency problems need to be compensated ex ante for the increased cost of monitoring or to price-protect from potential rent-seeking by the CEO (e.g., Ashbaugh-Skaife, Collins, and LaFond, 2004). However, Bertrand

and Mullainathan (2003) find evidence that CEOs prefer the "quiet life" so they actually may be less inclined to shift to higher risk projects when they are not as intensively monitored. Their preference for lower risk may result in lower cost of equity capital instead.

There are also other arguments for how the size of a CEO's personal connections can affect risk-taking and so affect the cost of equity. Personal contacts are very important in the job search process (Granovetter, 1974), and Mazerolle and Singh (2004) and Cingano and Rosolia (2012) show that re-employment outcomes following job displacements greatly improve as an individual's social network size increases. Liu (2014) documents that CEO connectedness improves outside options, which can encourage departures for other full-time positions. As risk-taking entails a greater chance of failure for the CEO, a bigger social network can provide implicit labor market insurance. Furthermore, better-connected CEOs can access relevant network information to better identify and execute valuable risky investment opportunities. This reduces the ex-ante risk of failure and encourages risk-taking by the CEO. Consistent with networks alleviating risk aversion and providing access to relevant investment-related information, Faleye, Kovacs, and Venkateswaran (2014) and Ferris, Javakhadze, and Rajkovic (2017a) find that CEO connections facilitate risky corporate investments. Therefore, a bigger CEO social network can increase the cost of equity through its impact on increased CEO risk-taking.

The three channels via information asymmetry, agency, and risk-taking, by which CEO connections can affect the cost of equity are not mutually exclusive and can operate simultaneously. The net effect of CEO connections on a firm's cost of capital is therefore ambiguous. In this paper, we estimate the empirical relation using measures of CEO's connectedness to business executives in other firms and measures of a firm's implied cost of capital. We also examine whether each of the channels are more likely to operate in certain segments of firms. We build our measure of CEO

connections following Engelberg, Gao, and Parsons (2013) by counting the number of executives and directors that the CEO is connected to via common employment, education, and social activities outside the boundary of the focal firm. We calculate the cost of equity implied by analyst's earnings forecasts and current stock price using the four accounting-based valuation models of Claus and Thomas (2001), Gebhardt, Lee, and Swaminathan (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005). Following Hail and Leuz (2006, 2009) and Houston, Lin, and Xie (2015), we average the values from the four models in excess of the risk-free rate to obtain the implied cost of equity measure as the main dependent variable.

We find that the size of a CEO's network is significantly and positively associated with the implied cost of capital after controlling for the standard controls from extant literature, including proxies for systematic and idiosyncratic risks. The effect is not only statistically significant, but also economically meaningful. A one standard deviation increase in the number of CEO's connections leads to an incremental higher cost of capital by 23.2 basis points, which translates to 4% higher cost relative to the average cost of capital. The average firm in our sample has outstanding equity of $3,371.12 million, so this translates into additional costs of $7.82 million for firms financing using equity.

We implement several tests to alleviate endogeneity concerns relating to omitted variables bias. First, the results are robust to additional controls for CEO tenure, age, compensation, and ability. Second, we control for firm governance characteristics and board characteristics to alleviate concerns that the CEO network size might proxy for the effectiveness of the firm's corporate governance and we reach similar conclusions. Third, additional control variables relating to firm distress risk, investments, asset structure, and analyst coverage also do not affect the inference of a positive relation between CEO network size and cost of capital. The results are also

robust to controlling for firm fixed effects, CEO fixed effects, and industry-year fixed effects. Finally, we also implement a propensity score matched sample analysis to control for observable differences between firms with highly connected CEOs and less-connected CEOs and reach similar conclusions.

To address issues relating to reverse causality, we implement difference-in-difference tests surrounding CEO turnovers. We find that a change in CEO network size due to the appointment of a new CEO is positively related to future changes in cost of equity capital but past changes in the cost of equity is not associated with current changes in CEO network size, suggesting that the direction of causality runs from CEO connectedness to cost of capital.

We conduct additional tests to identify the specific channels through which social connections impact cost of capital. The results show that the positive impact of CEO connections on capital cost is predominantly among firms with weak governance where the potential for agency issues is higher, providing support for the agency channel. In addition, using a simple regression discontinuity design (RDD) setting, we find that cost of equity is reduced upon the passing of shareholder proposals to remove antitakeover provisions, consistent with agency problems affecting the cost of capital. Importantly, the reduction in cost of capital is only evident among the firms with low CEO connectedness, providing further support for the agency channel.

We also test for the presence of the risk-taking channel. We find a steeper positive CEO connections-cost of capital relation among younger CEOs with more career concerns, consistent with connections encouraging risk-taking behavior by expanding the outside options of the CEO to insure against firing costs. We find a stronger positive relation between CEO connections and cost of capital where the connections are more likely to contain industry-relevant information such as connections to industry rivals and to upstream or downstream firms, consistent with CEO

connections providing better access to relevant information so that CEOs can better identify and exploit risky investment opportunities. Consistent also with increased risk-taking, we document positive relations between CEO network size and various proxies of firm risks and risk-taking behavior.

Finally, we also test whether CEO connections facilitate information flow between the firm and outsiders. Informationally-opaque firms should benefit most from the information flow with outsiders that a highly-connected CEO can facilitate. Therefore, the agency and risk-taking costs of having a highly-connected CEO on the cost of equity may be offset by the benefits of increased information flow. Indeed, we find that the positive relation between CEO connections and cost of capital is attenuated for informationally-opaque firms, suggesting that CEO network might be useful in reducing information asymmetry for certain segments of firms.

This study contributes to the accounting literature in the following ways. We add CEO connections as a new determinant of the cost of equity capital. Previous studies on the determinants of cost of capital focused on firm-level characteristics. These include information risk (Easley and O'hara, 2004; Francis, LaFond, Olsson, and Schipper, 2005; El Ghoul, Guedhami, Ni, Pittman, and Saadi, 2013), voluntary disclosure and disclosure quality (Chen, Miao, and Shevlin, 2015; Cao, Myers, Tsang, and Yang, 2017), corporate tax avoidance (Goh, Lee, Lim, and Shevlin, 2016), shareholder taxes and financial constraints (Dai, Shackelford, Zhang, and Chen, 2013), firm reputation (Cao, Myers, Myers, and Omer, 2015), corporate social responsibility performance (El Ghoul, Guedhami, Kwok, and Mishra, 2011), financial restatements as a measure of reporting quality (Graham, Li, and Qiu, 2008), and governance (Chen, Chen, and Wei, 2009, 2011; Lin, Ma, Malatesta, and Xuan, 2013).

Despite the growing literature on the importance of CEO characteristics in influencing firm behavior, few studies examine how CEO characteristics are associated with the cost of equity. Mishra (2014) shows that generalist CEOs are associated with a higher cost of capital whereas we study CEO social connections. Engelberg *et al.* (2012) and Ferris *et al.* (2017b) study social connections to financiers only whereas we examine connections to a broader community of all outside firms. We also examine and show both the adverse and beneficial effects of CEO connections on the cost of capital. In particular, we attempt to isolate when beneficial or adverse effects are likely to dominate in additional cross-sectional tests, such as the importance of CEO connections in reducing information asymmetry for reducing cost of capital especially among the informationally-opaque firms.

This paper relates also to the literature on corporate governance effects on cost of equity. These studies find that the cost of equity is lower for firms with good governance (Ashbaugh-Skaife *et al.* (2004), no internal control deficiencies (Ashbaugh-Skaife, Collins, and Lafond (2009), with strong shareholder rights (Chen *et al.* (2011), and in countries with good legal protection (Chen *et al.* (2009). Our evidence shows that the effect of CEO connectedness on the cost of capital is incremental to corporate governance effects, as well as interacts with corporate governance effects. We find that CEO connectedness increases cost of capital after controlling for corporate governance variables, and that CEO connectedness increases cost of capital especially in companies with weaker corporate governance.

Lastly, we contribute to the literature on economic effects of social networks. Previous studies have related CEO ties to the firm's directors or bank lenders, whereas we examine CEO tiers to the broad community outside the firm. The previous studies that examine CEO ties to the broader community have focused on ex post outcomes for investment and firm value. In contrast,

we are interested in how CEO ties to the broader community affect the firm's ex ante implied cost of capital through effects on information asymmetry, agency costs, and risk-taking channels.

The remainder of this paper is as follows. Section 2 describes the sample and variable construction and the empirical model used in the regressions. Section 3 presents the main empirical results and analysis. Section 4 discusses potential endogeneity issues and section 5 looks at additional test results and examines the mechanisms through which CEO connections affect the cost of equity. Finally, section 6 concludes the paper.

2. Data and methodology

We start with the list of firms and CEOs on Execucomp. We obtain data on CEO characteristics and personal connections from Boardex database by Management Diagnostic Limited. Boardex provides detailed biographical information on executives and directors of public companies, private companies, and not-for-profit companies. The information includes their work, education, and social information as well as their personal profile. The information on CEO compensation is from Execucomp, financial data from Compustat, stock return and pricing information from Center for Research in Security Prices (CRSP), and analyst forecast information from Institutional Broker's Estimate System (IBES).

The main sample consists of firm-year observations in the intersection of Boardex, Execucomp, Compustat, CRSP, and IBES. We begin our sample from 2003 as the coverage in Boardex is incomplete prior to 2003. The last year of the data is 2014. The sample includes 10,507 firm-year observations from 1,943 unique firms that have non-missing values for the main regression variables. In addition, we collect data on anti-takeover provisions, board structure data,

and shareholder voting results from ISS (formerly RiskMetrics) databases, and the institutional holdings data are taken from the Thomson Reuters 13F institutional ownership database.

2.1 Variable definitions

a. Measures of Implied Cost of Capital

We estimate the cost of equity that is implied in the current stock prices and the consensus of individual analysts' forecasts as provided by IBES. We adopt the four accounting-based valuation models by Claus and Thomas (2001), Gebhardt *et al.* (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005).[2] These four models make different use of analyst's earnings forecasts, forecast horizon, and have different assumptions regarding the long and short-term growth rates.

To compute the implied cost of capital for each of the models, we extract the analyst forecasts on one-year-ahead and two-year-ahead earnings per share (EPS) and long-term growth rate forecast from IBES. We require the forecasts to be positive. We further require each firm-year observation to have information on book value of equity, shares outstanding, earnings, and dividends from Compustat, and stock price information from CRSP. Following Gebhardt *et al.* (2001), we use the median values of analyst forecasts as of June each year. This ensures that the financial information from the previous fiscal year is reflected in the stock price at the time of estimation and that the information is publicly available.[3] We constrain each estimate of implied cost of capital to be positive, and treat observations as missing if the observations have negative values.

[2] CT, GLS, MPEG, and OJ models, respectively.
[3] We have tried restricting our sample to the firms with December fiscal year-end, and also excluded firms with April or May fiscal year-ends and run our main regressions. The results are qualitatively the same.

There is little consensus on which model performs best, thus we follow the previous literature and take the average of the four estimates (Hail and Leuz, 2006, 2009). This can mitigate the possible measurement errors associated with a particular model. We calculate the average cost of capital only for firm-year observations that are not missing any of the four estimates. We also show results separately for the cost of equity estimate from each of the models. Finally, from the average estimate and each individual model estimates, we subtract the risk-free rate, as proxied by the 10-year US treasury bond yield in June of each year, to generate implied equity risk premiums. We use these implied equity risk premiums as the dependent variables.

Estimating the firm's *ex-ante* cost of capital using accounting valuation models has advantages over conventional approach that relies on realized stock returns to calculate the cost of capital. Elton (1999) suggests that realized return is a poor proxy for the cost of capital. As argued by Hail and Leuz (2006, 2009), the implied cost of capital is useful because the accounting-based valuation models separately incorporate growth and cash flow estimates making them suitable for isolating changes in the cost of capital. In addition, accounting-based valuation models can estimate cost of capital without using the time-series of past returns, therefore they are forward looking and are more likely to closely mimic investors' expected returns (Hail and Leuz, 2006; Pástor, Sinha, and Swaminathan, 2008; Hail and Leuz, 2009). The details on the computation of each model can be found in Appendix A.

These measures of implied cost of capital are not without limitations. Hou, van Dijk, and Zhang (2012) (HDZ) argue that the cost of capital estimated from analyst forecasts are not reliable since analysts tend to be overly optimistic. They suggest a new approach to forecast earnings by estimating a cross-sectional model using accounting numbers and then use these forecasted earnings in place of earnings forecasted by analysts in the four cost of capital models. They find

that their cost of capital estimates better predict future stock returns than the traditional cost of capital estimates generated using analyst forecasts. Therefore, following HDZ, we also re-estimate the four individual cost of capital estimates using the earnings forecasts from the cross-sectional regression models. We then take the average of these four models and subtract the risk-free rate to arrive at a HDZ cost of capital estimate. Following their paper, we only require one non-missing individual cost of capital estimates to come up with the composite measure to maximize coverage. Details on how to estimate the cross-sectional earnings forecast models can be found in Appendix B.

b. Measures of CEO's connections

We match firms in Boardex to Compustat and CRSP using both manual and computer matching (Kamiya, Kim, and Park, 2016). The matched Boardex-Compustat-CRSP universe of firm-years is the basis for the construction of our network connections. Next, we match the CEO names in Execucomp with those in Boardex in order to obtain the social profile and network of the CEO. We are able to match about 95% of all CEOs in Execucomp, and the final sample that we use consists of 2,863 unique CEOs after requiring non-missing control variables and the cost of equity capital estimates.

Following Engelberg *et al.* (2013), we calculate the size of CEOs' personal connections as the total number of executives and directors in the matched Boardex-Compustat-CRSP universe to whom the CEO has an employment, university, or other social connection. Hence, connection is not counted for the individuals in private companies that are not in Compustat and CRSP or

firms that are not covered by Boardex. Also, we follow Faleye *et al.* (2014) and assume that once a connection is established, the two individuals are connected in the following years.[4]

The CEO is connected to an individual via employment links if both worked at or sat on the board of another company at the same time during or before the current year. We exclude connections initiated from the CEO's current employment. A university connection is established when two individuals attended the same university and graduated within one year of each other with the same degree type.[5] We follow Cohen *et al.* (2008) and categorize the degree descriptions into six types: (1) undergraduate, (2) masters, (3) MBA, (4) Doctor, (5) Law, and (6) Others. We require that the graduation date to be before the given year of observation. A social connection exists when two individuals are active members of the same social organization, such as clubs, associations, and charities. As the starting and ending date of joining such social organizations are mostly missing in Boardex, we do not impose restrictions on the date that an individual has joined or left the organization when defining social connections similar to past literature.

c. Control variables

We control for the standard variables that are documented to be important in determining the cost of capital. Firm size is calculated as the natural logarithm of the market value of common equity; leverage is measured as the ratio of long-term debt to the market value of equity; and book to market ratio equals the natural logarithm of the ratio of book value of equity to the market value of equity. We also include market beta and idiosyncratic risk calculated from historical daily

[4] However, individuals may drop out of the Boardex database because of death instead of data error. Therefore, we also drop this assumption and reconstruct the CEO connections variable and find similar results.

[5] The institution ID in Boardex reflects multiple schools within the same university, therefore, these IDs are aggregated into a single university ID. For example, the institution ID for "Harvard University" is 764747769, "Harvard Business School" is 755756849, and "Harvard Law School" is 756006873. These are merged into "Harvard University" and given a new university ID.

returns. In particular, beta is estimated using the market model with CRSP value-weighted return and the stock's daily returns over the 12 months prior to the time of implied cost of capital estimation. Idiosyncratic risk is the standard deviation of the residuals from the market model.

Following Dhaliwal, Judd, Serfling, and Shaikh (2016), we include two additional variables, price momentum and analyst forecast dispersion, to account for the potential sluggishness when analysts process information from stock prices and to mitigate any impact of forecast errors on the cost of equity estimates, respectively. We define momentum as the natural logarithm of one plus the compounded daily stock returns over the previous 12 months and analyst forecast dispersion as the standard deviation of analysts' estimates of one year ahead earnings per share forecast. Additionally, consistent with Chen *et al.* (2011) and Cao *et al.* (2015), we add the median analysts' long-term growth forecast from IBES to control for the potential bias in the cost of equity estimate that can arise from analysts' forecast optimism. All control variables in the regressions are winsorized at 1% and 99%, unless the variable is an indicator variable. All independent variables are standardized to have mean of zero and standard deviation of one unless noted otherwise. The detailed definitions of all variables are in Appendix B.

d. Summary statistics

Table 1 shows the descriptive statistics for CEO connections (Panel A), the implied equity risk premium, and other main control variables (Panel B). A CEO has an average of about 135 total connections, out of which 53 are employment connections, 9 are education connections, and 72 are social connections. We observe that the standard deviations of the connections measures are quite large. These numbers are consistent with previous literature such as Engelberg *et al.* (2013)

The average implied cost of capital estimate across the four models is 5.75%. The CT and GLS models have relatively lower equity premiums (4.38% and 4.03%, respectively) compared to OJ and MPEG models (7.34% and 6.84%, respectively). This observed pattern is consistent with previous documentations, such as Gode and Mohanram (2003) and Dhaliwal, Heitzman, and Zhen Li (2006), which shows that OJ model provides the upper bound and GLS model provides the lower bound to costs of capital estimates. The HDZ model also gives a relatively higher number at 6.12%.

2.2. Empirical methodology

To examine the relation between the size of CEO connection and the cost of capital, we estimate the following panel regression model at the firm-year level as the baseline regression:

$$
\begin{aligned}
Cost\ of\ Capital \\
&= \alpha + \beta \cdot CEO\ connections + \gamma_1 \cdot Firm\ size + \gamma_2 \cdot Book\ to\ market + \gamma_3 \\
&\cdot Leverage + \gamma_4 \cdot Momentum + \gamma_5 \cdot Forecast\ dispersion + \gamma_6 \\
&\cdot Long\ term\ growth + \gamma_7 \cdot Beta + \gamma_8 \cdot Idiosyncratic\ risk \\
&+ Year\ fixed\ effect + Industry\ fixed\ effect + \varepsilon
\end{aligned}
$$

where the dependent variable is the implied cost of capital of a firm as of June in each year. *CEO connections* and financial statement items are measured for the most recent fiscal year ending before the estimation month of the dependent variable. The analyst-related and risk items are measured in the contemporaneous year as the dependent variable. Throughout the paper, unless noted otherwise, we include year fixed effects and industry fixed effects at the two-digit SIC level, and cluster standard errors at the firm level.

3. Empirical analysis and results

3.1. CEO connections and cost of equity

We begin our analysis by examining whether the size of the CEO's personal network impacts the firm's cost of equity capital. The results are represented in Table 2. The dependent variable in Columns 1 to 3 is the average implied cost of capital. We show results with and without the risk measures, beta and idiosyncratic risk, as CEO connections could impact cost of equity through its impact on firm risk-taking and controlling for risk might attenuate the effects of CEO connections. In Column 1, where we do not control for risk, we find that CEO connections positively and significantly affect a firm's cost of equity capital. The result is economically meaningful as well. A one standard deviation increase in the CEO social connections is associated with a cost of equity that is about 23.2 basis points higher. This translates to about 4% rise in the cost of capital relative to the sample mean. The average firm in our sample has outstanding equity of $3,371.11 million, a 23.2 basis point increase in its cost of equity implies $7.82 million additional cost every year for the firm to finance with equity.

Following prior literature, we control for systematic and idiosyncratic risks in Columns 2 and 3. The positive effects of CEO connections on cost of equity is slightly attenuated though by not much. To be conservative, we use the specifications in Column 3 for the rest of our paper. As expected, both measures of risks are positively related to the cost of equity. The signs on the other control variables are consistent with prior literature. Bigger firms have lower costs though this is likely to be due to the impact of size on firm risks as the significance of the coefficient on firm size disappears in Columns 2 and 3 after controlling for beta and idiosyncratic risk. Consistent with prior literature, the cost of equity is also positively related to *Book to market*, *Leverage, Forecast dispersion, and long-term growth rates* and negatively related to *Momentum*.

Columns 4 to 7 are regression results using individual cost of capital model estimates as the dependent variable. Except for the GLS model in Column 5, the coefficients of *CEO connections* are all positively and statistically significant at the 1% level. The economic significance are also similar to that in Column 1. Therefore, no single model is driving the results in Columns 1 to 3.

To mitigate the concern for optimism bias in analysts' earnings forecast, we follow Hou *et al.* (2012) and use earnings forecasts generated from a cross-sectional model to estimate the implied cost of capital. The regression result is shown in Column 8 and we still find largely similar result. Overall, the results in Table 2 show that a firm with larger CEO network has higher cost of capital. These results are consistent with the agency channel and risk-taking channel.

3.2. Alternative specifications for CEO connections

Table 3 shows regression results with alternative specifications for the connectivity measure. Column 1 uses the residual from regressing *CEO connections* on firm size to ensure that the result is not driven by the correlation between *CEO connections* and firm size. Column 2 takes the natural logarithm of CEO connections to account for outliers. In Column 3, we use the percentile ranking of *CEO connections* rather than the raw number of CEOs' social ties (Engelberg *et al.*, 2013). Finally, we use CEOs' centrality measure in the last column, which is the number of a CEO's connection scaled by the gross number of all CEOs' connections in each given year (Hochberg, Ljungqvist, and Lu, 2007). The positive relation between cost of equity and CEO connections is robust to all these alternative specifications.

4. Addressing potential endogeneity

The results presented in the previous section is consistent with CEO connections having a positive impact on the cost of equity capital. However, the relation between CEO network and the cost of capital is not free from potential endogeneity problems. The main concern for endogeneity problem arises from omitted variables which can cause the simultaneity bias. To address this issue we control for additional variables and also use different fixed effects to control for unobservable firm and CEO characteristics in a linear framework. However, *CEO connections* might be picking up nonlinear effects of these linear control variables. Therefore we also use a propensity score matching approach where we match on observed firm and CEO characteristics. Finally, we implement a difference-in-difference methodology surrounding CEO turnover to reduce reverse causality and CEO selection concerns.

4.1. Additional Control Variables

We first address the omitted variables problem with additional control variables and also various fixed effects. We present the results in Appendix C. Note that by including additional control variables, we might be biasing against us as some of the additional control variables control for the effects of *CEO connections* itself. The size of a CEO's network may be related to several CEO characteristics and compensation structure which prior studies have found to affect firm risk-taking and agency issues and in turn, the firm's cost of equity. Therefore, we control for CEO age and tenure (e.g., Berger, Ofek, and Yermack, 1997; Serfling, 2014), cash compensation, and compensation structure as proxied by CEO portfolio delta and vega (Guay, 1999; Ang, Cole, and Lin, 2000; Coles, Daniel, and Naveen, 2006). We also control for CEO ability by including the general ability index from Custódio, Ferreira, and Matos (2013) and a dummy variable indicating whether the CEO is from an Ivy League school. In addition, we include an indicator variable for

CEO overconfidence to control for CEO's risk-taking behavior (Hirshleifer, Low, and Teoh, 2012). *CEO connections* continue to be significant at the 1% level with similar economic magnitude after including these additional control variables.

Papers have shown that a firm's level of agency problems affect the cost of equity capital (e.g., Ashbaugh *et al.* 2004). In Column 2, we control for board and governance-related variables. We include as additional control variables the number of blockholders, institutional ownership percentage, the degree of intense monitoring by the board (Faleye, Hoitash, and Hoitash, 2011), board size, audit committee size to board size (Lin, Li, and Yang, 2006), CEO ownership, existence of internal control deficiency (Ashbaugh-Skaife *et al.*, 2009), and the number of independent directors in his own firm the CEO is socially connected to (e.g., Hwang and Kim, 2009). We also follow Larcker *et al.* (2013) to control for board connectedness. We also control for CEO power as proxied by CEO pay slice (Bebchuk, Cremers, and Peyer, 2011), whether the CEO is the only insider on the board (Adams, Almeida, and Ferreira, 2005), and whether the CEO is also the chairman of the board and president (Adams *et al.*, 2005). After controlling for the various board and governance-related variables, *CEO connections* is still positively significant.

Next, we include additional variables related to firm characteristics that might affect a firm's cost of equity. We control for squared firm size to capture any quadratic relation between firm size and cost of capital; firm age to control for firm life-cycle dynamics; *Altman's Z* to control for default risk; *PPE* to control for tangible assets; *CAPEX* and standard deviation of ROA to capture investment and firm risk, respectively; R&D expense and discretionary accruals to control for information asymmetry; *Number of segments* to control for the complexity of firm structure; and *Free cash flow* to control for financial flexibility (e.g. Almeida, Campello, and Weisbach, 2004). *CEO connections* continue to be significant. Next, we control for analyst coverage, as

proxied by the number of analysts covering the firm, and analysts' forecast bias and the results continue to be robust. Finally, we also control for all the CEO, board, governance, firm, and analyst-related variables in a single regression and *CEO connections* continue to be significant at the 1% level.

We also control for various fixed effects, such as firm fixed effects instead of industry fixed effects to exploit within-firm variation in the *CEO connections* variable. Next, we add CEO fixed effects in addition to industry fixed effects and year fixed effects. Our results continue to hold. We also control for industry-year fixed effects and find similar results. Therefore, the positive relation between CEO network size and cost of equity capital is unlikely to be driven by time-invariant firm and CEO characteristics or industry time trends.

4.2. Propensity score matching

We have controlled for various additional CEO and firm characteristics in a linear regression, however, if the linear control variables used in the regressions do not fully capture the differences between firms with varying CEO network size, the *CEO connections* measure can pick up the non-linear effects of the control variables (Dhaliwal *et al.*, 2016). Therefore, we use propensity score matching to alleviate such non-linearity concerns and concerns of endogenous selection on observable variables (Rosenbaum and Rubin, 1983; Roberts and Whited, 2013).

First, we form two groups with respect to the size of CEO's network. The treatment group is the group with above median *CEO connections* while the control group is the group with below median *CEO connections*. Next, we run a logit regression model where the dependent variable is an indicator variable equals to one if the firm belongs to the high *CEO connections* group and zero if the firm belongs to the low *CEO connections* group. We use two sets of matching covariates.

The first set includes the control variables used in the baseline regression in Table 2 Column 3. The second set includes additional CEO characteristics and pay structure as matching covariates. We obtain the propensity score, which is the predicted probability that firm has a highly connected CEO from the logit regression. Next, we match each treated firm (high CEO connections) to a control firm (low CEO connections) with the closest propensity score from the same year and from the same industry. We use kernel matching and nearest neighbor matching without replacement. The match is done within the same 2-digit industry and same year.

The results are presented in Table 4. In Panel A, we compare the means of the matching covariates for the sample matched using kernel matching with bandwidth 0.0005 and where we include additional CEO matching covariates. The resulting sample consists of 1,124 pairs of firms with high and low connected CEOs. The means of all matched variables are insignificantly different from zero between the treated and matched sample, except for CEO age. Therefore the matching is generally successful. The comparison of the matching covariates for the other specifications are not reported for brevity but the untabulated results show that the match is robust to using one-to-one nearest neighbor matching without replacement, and with and without CEO covariates.

Panel B compares the cost of equity between the high *CEO connections* group and low *CEO connections* group for different match specifications. Specification (1) compares the cost of equity between high *CEO connections* and low *CEO connections* group for the match done using kernel match with bandwidth of 0.00025 and standard control variables from Table 2 Column 3.[6] Specification (2) corresponds to the matches for the specification used in Panel A (Kernel matching with additional CEO matching covariates). Both specifications show that firms with

[6] We use different bandwidths to minimize the difference in matched covariates between treatment and control groups.

highly connected CEOs have 36 basis points higher cost of equity capital compared to firms with CEOs that are relatively less connected. The differences are significant at the 5% level.

Specifications 3 and 4 show the results of nearest neighbor matching without replacement. Specification 3 includes only firm characteristics as matching covariates while specification 4 includes both firm and CEO characteristics.[7] Again, we find that firms with highly connected CEOs have higher cost of equity capital compared to firms with less connected CEOs.

4.3. Reverse causality and selection issues

We argue that a bigger CEO social network causally affects cost of equity. However, changes in cost of equity may affect a CEO's social network. For example, firms which became financially distressed may experience an increase in cost of capital, these firms may then hire a CEO with a large social network as the CEO potentially can tap into his vast resource network to engineer a turnaround for the firm. If this is the case, we should see that an increase in the cost of capital precede an increase in CEO connectedness surrounding CEO turnover. The increase in CEO connectedness would then be followed by a decrease in cost of capital if the highly-connected CEO manages to stage a turnaround. To rule out such CEO selection issues, we implement a difference-in-difference (DiD) test to examine how changes in CEO connectedness surrounding CEO turnover affects lead and lag changes in cost of equity.

We first start with a sample of 620 CEO turnovers in our sample. We compare CEO names in consecutive years to determine whether a turnover takes place or not. Next, we calculate the change in *CEO connections* around the CEO turnover and then partition the sample of turnovers

[7] We require the propensity score to be within +/-0.0085 of each other in specification 3 and +/- 0.025 of each other in specification 4. The use of different calipers is because some covariates fail to match when we use the same caliper in both specifications.

into quartiles based on the size of CEO connection change. Those turnovers that fall in the top quartile has the highest increase in CEO connections while those turnovers that fall in the bottom quartile has the lowest increase (largest decrease) in CEO connections. On average, the top quartile experience an increase in *CEO connections* by 138 and the bottom quartile experience a decrease in *CEO connections* by 153. Next, we compare the average change in cost of capital for the top and bottom quartile to calculate the DiD estimates of the cost of capital.

Table 5 shows the result from the DiD tests. Panel A shows the effect of CEO connections changes over *T*-1 to *T* (turnover year) on changes in cost of capital post-turnover, i.e., *T* to *T*+1 while Panel B examines longer-term changes in cost of capital from *T* to *T*+2. The average change in cost of equity is reported for the top quartile CEO connections change group and the bottom quartile CEO connections change group. When we examine the shorter-term changes in Panel A, we find that the average cost of equity decreases for both groups of firms and the average changes are not significantly different from each other across the two groups. However, when we examine the longer-term change in Panel B, we find that the average cost of equity drops by 29 basis points for firms with the biggest decrease in CEO connections while the average cost of equity increases by 40 basis points for the firms with the biggest increase in CEO connections. The average changes in cost of equity are significantly different from each other across the two groups at the 5% level. It is unclear when the market incorporates the impact of the new CEO into stock prices. Investors may have partially revised their expectations immediately following the turnover, thereby cost of equity would have changed already at time *T*. This would bias downwards our estimates of the change in cost of equity. Therefore, we further present the changes in cost of capital from *T*-1 to *T*+1 in Panel C and *T*-1 to *T*+2 in Panel D. The results are qualitatively the same as Panels A and B, respectively, although the DiD estimates are bigger as expected.

Next, in Panel E, we show that changes in CEO connections due to the turnover is independent of the change in cost of equity prior to the turnover. The sample of turnovers are divided into 4 groups based on the change in cost of capital prior to the turnover, i.e., *T*-2 to *T*-1. We next compare the change in CEO connections from the old CEO to the new CEO, i.e., *T*-1 to *T*, between the bottom quartile group and top quartile group. The result shows that past changes in implied cost of capital do not significantly impact the selection of new CEO with larger social network.

Therefore, the documented positive relation between CEO connections and cost of equity is unlikely to be due to firms with higher cost of capital selecting CEOs with bigger networks. These results are more consistent with changes in CEO connections causally affecting cost of equity and also suggest that the information on CEOs' network size changes takes time to be fully reflected in the cost of capital.[8]

5. Additional tests

In this section we provide further analyses of the relation between CEO connections and the cost of capital. First, we examine the types of connections that are most relevant in determining a firm's cost of capital. We then attempt to identify the channels through which CEO connections influence a firm's cost of capital. We consider three channels with which CEO connections can affect the cost of capital – agency channel, risk-taking channel, and information asymmetry channel. Note that these three channels are not entirely mutually exclusive. Therefore, our goal is

[8] We also look at connection changes over *T*-2 to *T* and its impact on cost of equity changes from *T* to *T*+1 and *T* to *T*+2. The results are only significant for the longer-term change, supporting the finding that information about CEO connection changes propagates slowly into the cost of capital.

not to preclude one channel in favor of another but simply to provide evidence to show that all channels are at work in the data, if indeed this is the case.

5.1. Regression by individual components of CEO connections

Which types of connections are the most important in determining the cost of equity capital? We split the connections of the CEO into the three subgroups - employment, education, and other social connections in Table 6. We include the standard control variables in the baseline regression.

Columns 1 and 3 show that connections arising from prior employment and other social activities, respectively, positively affects the cost of equity. However, in Column 2, university connections negatively affects cost of equity. Some of the largest educational networks in our data come from the top U.S. schools. Therefore, one possible explanation for the negative relation between number of university connections and cost of equity could be that university connections proxy for the latent ability or skill of the CEOs and high-ability CEOs may be able to manage the firm better leading to lower costs of capital (Engelberg *et al.*, 2013). In Columns 5 to 7, we divide the education connections into those arising from Ivy League schools and those arising from non-Ivy League schools to examine more directly whether education connections captures CEOs' latent ability. We find that only connections arising from Ivy League schools are significant and negative in predicting cost of equity. Putting these evidences together, it seems that the negative coefficient of education connections is driven by connections from a few elite schools which may be partially correlated with CEOs' managerial ability.[9]

[9] Alternatively, the mechanism through which education connections affect cost of equity may be different from the mechanism through which employment and other social connections affect cost of equity. It could be the case that the information transfer between parties with the same education background is more effective which reduces information asymmetry between the firm and outsiders, leading to lower cost of capital (Diamond and Verrecchia, 1991; Francis *et al.*, 2004; Cao *et al.*, 2015; Chen, Li, and Zou, 2016). There is supporting evidence that communication is more effective when the parties share more similarities (Rogers and Bhowmik, 1970) and that the

5.2. Evidence for agency channel

a. Cross-section results by governance measures

Prior research finds that agency problem increases with the size of CEOs' network (Kirchmaier and Stathopoulos, 2008; Kramarz and Thesmar, 2013; El-Khatib *et al.*, 2015). Therefore, if CEO network affects cost of capital through the agency channel, the impact of CEO connections would be more evident when the potential for agency problem is higher. More specifically, the need to monitor a highly-connected CEO by outside investors would be higher for firms with more room for potential agency problem. This leads to an increase in monitoring cost by outside investors which will be reflected in the implied cost of capital. Furthermore, the risk of expropriation by a powerful, unfettered CEO would also be higher causing investors to price-protect themselves through a higher required rate of return.

In Table 7, we use several proxies for the existence of agency problems. For Column 1, following Faleye *et al.* (2011), we create an indicator variable, *Intense monitor,* to indicate more intense monitoring by the independent directors and therefore less potential agency issues. *Intense monitor* is an indicator variable that equals one if the majority of independent directors serve on at least two of three monitoring-intensive committee (i.e. audit, compensation, and nominating). Column 2 interacts *CEO connections* with the indicator variable for small board size, *Small board.* The general consensus is that smaller boards are more effective at monitoring due to lesser free-rider issues (Yermack, 1996). In Column 3, similar to Lin *et al.* (2006), we use the ratio of audit committee size to board size as a proxy for governance. If this ratio is high, the firm is probably

relationships established in schools are more alike, socially and culturally, than those established in non-schools settings (Kalmijn and Flap, 2001).

focusing more on monitoring activities and improving corporate governance. *High Audit* is an indicator variable equals to one if the ratio is greater than the median, and zero otherwise. In Column 4, *High CEO own.* is an indicator variable equals to one if CEO percentage ownership is greater than the median, and zero otherwise. Core, Holthausen, and Larcker (1999) find that firms with higher CEO ownership percentage has more effective governance structure, leading to reduced CEO compensation. *ICD* is an indicator variable that equals to one if the firm has any internal control deficiency. Ashbaugh-Skaife *et al.* (2009) document a positive association between internal control deficiency and cost of capital. *CEO-Dir Indicator* equals to one if CEO has any social connections to his own independent directors. Hwang and Kim (2009) show that CEO connections to independent directors can increase agency problems.

Consistent with the agency channel, all the interaction terms are negative and significant at least at the 5% level, except for *ICD* and *CEO-Dir Indicator*, indicating that the impact of *CEO connections* is weaker when there is less potential agency problems, i.e., when there is more intense monitoring from board members. In firms with stronger governance, the risk of expropriation by a powerful, well-connected CEO is lesser and the need for extra monitoring by outside investors are also lesser.

b. Removal of antitakeover provisions

Evidence from previous literature suggests that removing antitakeover provisions (ATP) improve internal corporate governance by disciplining managers, thus increasing shareholder value (Cuñat, Gine, and Guadalupe, 2012). Therefore, we should expect the removal of ATPs to reduce the cost of capital. However, this reduction would be attenuated in firms with better-connected CEOs if CEOs' social network is the source of agency problem. Following Cuñat *et al.*

(2012), we implement a regression discontinuity design (RDD) using data from shareholder-sponsored governance proposals that seek to remove the ATPs a firm has. This empirical strategy essentially compares the change in the cost of equity for proposals that pass by a small margin to the change in cost of equity for proposals that fail by a small margin. For these close-call votes, passing of the proposal is very close to an independent, random event and is unlikely to be affected by firm characteristics. Put in another way, firms which pass the proposal by 50.1% votes should be quite similar to firms which fail the proposal by 49.9% votes but this small difference in the voting percentage generates a discontinuity in the likelihood that the ATP will be removed. Firms are more likely to remove the ATP if the proposal is passed compared to firms which fail the proposal, even by a little.

We obtain data on shareholder-sponsored proposals and their voting outcomes from ISS. In all, we find 1,292 shareholder proposals that can be matched to our sample. To implement the RDD, we follow Cuñat *et al.* (2012) and estimate the following regression $y_{i,t+1} = \alpha \cdot Pass_{i,t} + Polynomials_{i,t} + Year\ fixed\ effects + u_{i,t}$, where the dependent variable is implied cost of capital and the independent variable is an indicator variable *Pass* which equals to one if shareholders' proposal to remove anti-takeover provision has passed the threshold level, and zero otherwise. The order of polynomials included is limited up to second order because Gelman and Imbens (2014) argue that estimating causal effects based on higher order polynomials can be misleading and recommend using linear or quadratic polynomials. We include year fixed effects and cluster standard errors at the firm level. We estimate the model for the full sample and also for subsamples divided based on median *CEO connections*.

Table 8 reports the results. Column 1 shows results for the full sample. The coefficient on the *Pass* indicator variable is negative and significant, suggesting that passing a governance

proposal which seeks to reduce the number of ATPs leads to a decrease in the cost of equity capital. Therefore, agency cost has a positive impact on the cost of capital. In Columns 2 and 3, we separate the sample into those with below median *CEO connections* and those with above median *CEO connections*, respectively. The coefficient of *Pass* is significantly negative for the low CEO connectedness group while it is insignificant for the high CEO connections group. Furthermore, the coefficient of *Pass* is much larger in magnitude in the low CEO connectedness group compared to the high CEO connectedness group (-1.122 versus -0.268). To the extent that CEOs with high social connections enjoy significant power or suffer from high agency problems, we should observe more muted response to the removal of ATP for firms with powerful CEOs. Therefore, consistent with the findings in previous section, our result from the RDD further suggests that CEOs' personal connections increase agency problems leading to higher cost of capital and that good corporate governance can moderate its' impact.

5.3. Evidence for risk-taking channel

CEOs' network size can increase their risk-taking incentives as social networks facilitate relevant information transfer about potential investment opportunities and also improves re-employment options in the event that the risky venture fails and the CEO gets fired (Faleye *et al.*, 2014; Liu, 2014; Ferris *et al.*, 2017a). Therefore, a bigger CEO network can lead to an increase in cost of equity capital through its impact on aggregate corporate risk-taking. We examine this possibility in Table 9.

CEOs who are nearer to retirement have less career concerns and less worry about losing their job. Therefore, the expanded outside options provided by a bigger social network should matter less for older CEOs' risk-taking incentives. If so, we expect the impact of CEO connections

on cost of equity will be attenuated for the sample of older CEOs. In Panel A, we divide the sample of CEOs into two groups based on the median CEO age in the sample. Consistent with our expectations, the impact of CEO connections on cost of equity is stronger among the sample of younger CEOs. The coefficient of *CEO connections* for the younger CEOs is bigger in magnitude and also more significant, and it is significantly different at the 1% level from the corresponding coefficient for the older CEOs.

We next examine the possibility that CEO connections allow them to access relevant network information, which allows them to better identify investment opportunities, thereby reducing their risk aversion towards *ex-ante* risky projects. We identify types of connections which are most likely to contain investment-relevant information. We argue that connections to rival firms which are in the same industry as the focal firm and firms in the upstream or downstream industries are most likely to contain information relevant for the CEO. Rival firms are defined as firms that operate in the same three-digit SIC industry as the focal firm. To identify potential customer-supplier firms, we follow Fan and Goyal (2006) and use the 2007 Use Table of Benchmark Input-Output (IO) compiled by the Bureau of Economic Analysis (BEA) for the U.S. Economy to identify vertically-related industries.[10]

Table 9, Panel B, presents the regression results. *Rival connections* (*Non-rival connections*) is the number of executives and directors working in or sitting on the boards of rival firms (non-rival firms) that the CEO is connected to via employment, education, and other social activities. *Customer-supplier connections* and *Non-customer-supplier connections* are defined similarly but

[10] The table records the commodity flows between each pair of over 400 different IO industries. We calculate the vertical relatedness coefficient of each industry pair and identify vertically-related industries by requiring the coefficient to be greater than 5%. Then we match IO industry codes to the SIC codes using the concordance table provided by the BEA. Finally, we merge the identified vertically-related industry pairs with our data to identify the upstream and downstream industries of each firm and also to compute the number of connections to the firms in vertically-related industries.

for connections to firms in upstream and downstream industries. The variables in Panel B are not standardized so that we can compare the size of coefficients across different variables. Columns 1 to 3 show the regression results for rival and non-rival firm connections and Columns 4 to 6 show the results for customer-supplier and non-customer-supplier firm connections. All coefficients are positively significant consistent with the previous results. However, as expected, we find that the coefficient of *Rival connections* in Column 1 is much bigger in magnitude compared to the coefficient of *Non-rival connections* in Column 2. The two coefficients are also significantly different from each other at the 1% level as evidenced by the Chi-Square value of 10.01. In Column 3, when we put both types of connections together, we find that *Rival connections* is more important and its coefficient is significantly different from that of *Non-rival connections* with *p*-value 0.081. Similarly, we find that connections to upstream/downstream industries are more important compared to connections to other less relevant industries. The two coefficients in Column 6 are significantly different from each other at the 5% level.

Results in Panel B are also consistent with the idea that a bigger CEO social network lead to expanded outside options for the CEO which in turn increases their incentives to engage in risk-taking. The CEO's working experience in the current firm is likely to be a useful attribute for other firms in the same industry or for upstream or downstream firms. For example, executives with similar industry experience are highly sought after as directors (see e.g.,Wang, Xie, and Zhu, 2015; Corporate Board Member, 2016). Thus, CEOs who are more connected to rival firms or to customer or supplier firms are likely to have better labor market consequences from receiving more job offers from these firms than a CEO who is less connected to related firms.[11]

[11] It is possible that CEO social connections to important stakeholders can help foster better relationships and more stable operations, reducing cost of capital. However, on average, the net effect of CEO connections to potential suppliers and customers is positive in the data.

In Panel C, we examine directly the relation between *CEO connections* and several proxies of firm risk-taking. Our proxies for risk-taking include stock return volatility, earnings volatility, natural log of R&D spending, and natural log of *CAPEX*. If a bigger social network incentivizes the CEO to engage in risk-taking, we should see a positive impact of CEO connections on these proxies of risk-taking. Note however that prior literature often consider capital expenditure to be a safer form of investment compared to R&D (Coles *et al.*, 2006), therefore, CEO connections might have a negative impact on capital expenditures instead. We use the specifications from the baseline regression in Table 2 but do not include beta and idiosyncratic risk in the regressions. In Columns 1 to 4, we find statistically significant coefficient with expected signs for *CEO connections* suggesting that CEO connections positively impact firm risk-taking.

In Column 5, we use *accrual* to proxy for earnings management (see e.g., Healy, 1985; DeAngelo, 1986). Highly-connected CEOs have better outside options in case of failure, therefore, they may be more willing to take on risk and be more willing to engage in aggressive financial reporting. However, for similar reason, it is also possible that highly-connected CEOs have less incentive to engage in earnings management since they can easily find a new job if they get fired for underperformance. Therefore, it is left as an empirical question whether highly-connected CEOs increase or reduce earnings management. The result in Column 5 presents significantly positive coefficient for *CEO connections* suggesting that highly-connected CEOs engage in more earnings management activities.

Finally, in Columns 6 and 7, we regress firm beta and idiosyncratic risk on *CEO connections*, respectively. We find that the coefficient of CEO connections is positive but not

significantly related to systematic risk (*t*-value of 0.74), while it is positive and significantly related to idiosyncratic risk (*t*-value of 2.73).[12]

An important question to address here is whether the observed risk-taking behavior of connected CEOs is driven by the connectedness of the CEOs or whether firms with projected risk-taking activities appoint the CEOs with larger network to tap into their network. Similar to Hirshleifer *et al.* (2012), we test whether our risk-taking results hold for the sub-sample of long-tenured CEOs. The effect from firm-CEO matching is likely to be more important when the CEO is first assigned to the firm. And should diminish as CEO tenure increases. Therefore, we limit the sample of CEOs to those with tenure over four years and six years and re-run the tests from Panel C. In untabulated result, the overall results are qualitatively the same as in Panel C; CEO connections increase risk-taking behavior even for long-tenured CEOs. In Panel D, we show that the CEO connections variable is still positively significant even for the subsets of firm-years for which CEO has long tenure, suggesting that our results are not solely due to selection of highly-connected CEOs by firms which are expected to increase their risk-taking but the results are at least partially driven by highly-connected CEOs engaging in more risk-taking.

5.4. Evidence for information asymmetry channel

[12] The results are at odds with what can be expected from the traditional asset pricing models. However, there is a growing strand of literature documenting the pricing of firm-specific risk, which may result from market imperfections and failure of investors to fully diversify their portfolios due to exogenous reasons; such as taxes, limited attention, transaction costs, private information, as well as behavioral biases (see e.g., Fu, 2009). Our findings suggest that the positive relation between CEOs' network size and the implied cost of capital could be driven by firm-specific risk. However, as in previous literature on implied cost of capital (e.g., Hail and Leuz, 2006, 2009; Chen *et al.*, 2011; Dhaliwal *et al.*, 2016), both beta and idiosyncratic risk are controlled for in the regressions throughout the paper. Given that we continue to find a positive relation between CEO connections and cost of equity even after controlling for beta and idiosyncratic risk, the positive pricing of CEOs' ties must be beyond what can be explained by the included risk measures.

We find a positive relation between cost of equity and CEO network size which eliminates the possibility that on average, CEO connectedness helps to reduce information asymmetry. However, it is possible that this information asymmetry channel is at work in certain segments of firms, in particular, those informationally-opaque firms which would particularly benefit from the advantageous information flow conferred by a highly-connected CEO. We examine this possibility in Table 10.

In Panel A, we include various proxies for information asymmetry in the regressions and interact them with *CEO connections*. *Small size* is an indicator variable equals to one if the firm's market value of equity is below the sample median, and zero otherwise. Firm size is often used as a proxy for information asymmetry as smaller firm is more informationally opaque while information is readily available for bigger firms since they have more channels, such as media exposure and conference calls, through which information can be distributed (see e.g., Aboody and Lev, 2000; Cao *et al.*, 2017). *High accrual* is an indicator variable equals to one if *accrual* is higher than sample median and zero otherwise. Earnings management is predominantly done through the manipulation of accruals, and investors are heterogeneous in their ability to process earnings information. So poor earnings quality can exacerbate information asymmetry by differently informing investors (Diamond and Verrecchia, 1991). *High bid-ask* is an indicator variable equals to one if the bid-ask spread is higher than the sample median, and zero otherwise. *Few analysts* is an indicator variable equals to one if the number of analysts following the firm is below the sample median, and zero otherwise. *High volatility* is an indicator variable equals to one if the stock return volatility is above sample median, and zero otherwise. Firms with high bid-ask spread, with low analyst coverage, and higher stock return volatility have higher information

asymmetry (Lang and Lundholm, 1993; Armstrong, Core, Taylor, and Verrecchia, 2011; Cao *et al.*, 2015).

While the coefficients on the standalone *CEO connections* variable are all positive and significant, most of the coefficients on the interaction terms, other than the one on *High accrual*, are negative and significant, suggesting that the positive relation between *CEO connections* and cost of equity is attenuated among informationally-opaque firms. The results are consistent with the hypothesis that CEO connections induce better information flow between the firm and outsiders, which mitigates information asymmetry and helps reduce the cost of equity, especially among the informationally-opaque firms. At the bottom of Panel A, we provide the *p*-values which test the null hypothesis that the sum of the coefficients on the standalone *CEO connections* and the interaction term is equals to zero. The null hypothesis is mostly not rejected except for the *High accrual* interactions, suggesting that the adverse effect of agency and risk channels can be offset by better information flow through CEO network for the opaque firms.

In Panel B, we also look at the connections to capital providers to examine whether the information asymmetry channel is driven specifically by connections to capital providers. We follow Engelberg *et al.* (2012) and Ferris *et al.* (2017b) to define connections to banks and financiers. *Bank connections* (*Non-bank connections*) is the number of directors and executives who are working (not working) in banks or sitting (not sitting) on the boards of banks connected to the CEO via employment, university and other social links. Similarly, *Financier connections* (*Non-financier connections*) is the number of connections between the CEO and executives and directors who are working (not working) or sitting (not sitting) on boards of financier firms, which are classified as 'banks', 'investment companies', 'private equity', or 'specialty and other finance' in Boardex, through their past employment, university and other social links. There are some

evidence showing that connections to banks lead to a lower cost of equity capital while connections to non-banks increase the cost of capital, however, these results are only significant for the specification with firm fixed effects.

6. Conclusion

This study examines the relation between the size of the CEOs' social network and the implied cost of capital. We find that the *ex-ante* cost of capital increases with the number of CEO connections. The result is robust to different model specifications with various sets of control variables and alternative measures of CEO connections and cost of capital. We also alleviate concerns of endogeneity by using propensity score matching and difference-in-difference tests surrounding CEO turnover.

Additional tests also identifies three potential channels through which social connections influence the cost of capital. First, highly connected CEOs may have higher agency issues which leads to increased cost of equity capital. Using several governance measures, we find cross-sectional evidence that the size of CEOs' network has a larger impact for the firms with weaker corporate governance. This finding is further supported by using a regression discontinuity design to examine the impact on cost of equity following the passage of shareholder proposals to remove anti-takeover provisions.

Second, a big social network can incentivize the CEO to engage in riskier projects, thereby increasing the cost of capital. A big social network facilitates the CEO to take on riskier projects as it increases the outside options for the CEO following a potential job loss due to project failure. Furthermore, a highly-connected CEO can have access to investment-relevant information through his network which enhances his ability to identify good projects, thereby reducing the risk of

failure on an *ex-ante* basis. We find support for this risk-taking channel as results are stronger for younger CEOs more prone to career concerns issues and we also find a greater impact of connections that are more likely to contain investment-relevant information. CEO connections are also positively related to various risk-taking measures.

Third, personal network can be conduits of information between the firm and outside investors. We examine whether CEO personal connections can help alleviate information asymmetry issues for informationally-opaque firms and thereby reducing the cost of capital for these firms. We find some support for this information asymmetry channel as we find that the positive impact of CEO connections is attenuated for firms which has high information asymmetry.

Past papers have shown that CEO's personal connections to capital providers can lower information asymmetry and thereby the firm's cost of capital. Our study differs from these studies by examining the CEO's connectedness to the general business population. By doing so, we find that the impact of CEO's personal connections on cost of capital are more nuanced. CEO's connectedness to the general business population increases the cost of capital on average due to increase in agency issues and risk-taking. However, for certain segments of firms which are informationally-opaque, CEO's general connections act as conduits of information and helps lower information asymmetry between the firm and outside investors.

Appendix A. Models of individual cost of capital estimates

In this appendix, we describe in detail the cost of equity models used in the paper to estimate the implied cost of capital. All cost of capital estimates are estimated for June of year *t*. We obtain stock price information from CRSP, financial data from Compustat, and analyst-level data from IBES. In order to estimate the cost of capital for all models, we require each firm-year observation to have information on stock price in June of year *t* (P_t), dividend payout ratio (d_{t-1}), book value per share at the beginning of fiscal year (B_t), earnings forecasts one-year-ahead ($FEPS_{t+1}$) and two-years-ahead ($FEPS_{t+2}$) that are positive, as well as long-term growth forecast (*LTG*). However, some models require the use of earnings forecast beyond year two. Thus, we impute the forecast from the previous year's forecast and the long-term growth forecast if the forecast is not available (i.e. $FEPS_{t+i} = FEPS_{t+i-1}(1+LTG)$). The median analyst forecast of earnings and stock prices used are from June of each year *t* to ensure that the financial information from previous fiscal year is reflected in the stock price. The risk-free rate (r_f) equals to the yield on 10-year Treasury note in June of year *t*.

Once we have the implied cost of capital estimates, we constrain the individual cost of capital estimates to be positive and subtract the risk-free rate from each estimates to attain risk-premium. For the observations without any missing individual cost of capital estimates, we follow previous studies, such as Hail and Leuz (2006, 2009), and take the average of the four estimates in order to reduce the measurement error by individual models.

ICOC	Valuation equations and assumptions	Source
CT	$P_t = B_t + \sum_{i=1}^{5} \frac{(FEPS_{t+i} - k_{CT} \cdot B_{t+i-1)})}{(1+k_{CT})^i} + \frac{(FEPS_{t+5} - k_{CT} \cdot B_{t+4}) \cdot (1+g)}{(k_{CT}-g) \cdot (1+k_{CT})^5}$ where, k_{CT} = the implied cost of capital estimates that solves the equation, P_t = market price of stock in June of year t, B_t = book value of equity at beginning of fiscal year t, $B_{t+i} = B_{t+i-1} + FEPS_{t+i} \cdot (1-d)$, $FEPS_{t+i}$ = median analysts forecasts i-year ahead, $FEPS_{t+i} - k_{CT} \cdot B_{t+i-1}$ = residuals earnings at t+i which is the difference between forecasted earnings and cost of capital charged for book value of equity previous fiscal year end, d_{t-1} = dividend payout ratio. If earnings are positive, it equals to the dividends from previous fiscal year divided by earnings. If earnings are negative, it equals to the dividends over 0.06 × total assets. Replace payout ratio with zero if it is less than zero, and replace it with one if it is greater than one, $g = r_f - 3\%$.	Claus and Thomas (2001)
GLS	$P_t = B_t + \sum_{i=1}^{11} \frac{(FEPS_{t+i} - k_{GLS} \cdot B_{t+i-1)})}{(1+k_{GLS})^i} + \frac{(FEPS_{t+12} - k_{GLS} \cdot B_{t+11})}{(1+k_{GLS})^{11}}$ where, k_{GLS} = the implied cost of capital estimates that solves the equation, P_t = market price of stock in June of year t, B_t = book value of equity at beginning of fiscal year t, $B_{t+i} = B_{t+i-1} + FEPS_{t+i} \cdot (1-d)$,	Gebhardt *et al.* (2001)

	$FEPS_{t+i}$ = median analysts forecasts i-year ahead, After year t+3, *FEPS* mean revert linearly to median industry ROE (*FROE*) by 12th year, where industry is defined at two-digit SIC. Median ROE is computed using all profitable firms over the past 10 years. Where the forecasted return on equity is calculated as: $FROE_{t+i} = \frac{FEPS_{t+i}}{B_{t+i-1}}$, $FEPS_{t+i} - k_{CT} \cdot B_{t+i-1}$ = residuals earnings at t+i. Same as previously defined, d_{t-1} = dividend payout ratio. Same definition as in the previous model, $g = r_f - 3\%$.	
OJ	$k_{OJ} = A + \sqrt{A^2 + \frac{FEPS_{t+1}}{P_t} \cdot (g - (\gamma - 1))}$ where, k_{OJ} = the implied cost of capital estimates, $\mathrm{A} = \frac{1}{2} \cdot \left((\gamma - 1) + \frac{DPS_{t+1}}{P_t} \right)$ $FEPS_{t+i}$ = median analysts forecasts i-year ahead, $DPS_{t+1} = DPS_0$, dividend per share. Assumed to be constant, $\mathrm{STG} = \frac{FEPS_{t+2} - FEPS_{t+1}}{FEPS_{t+1}}$, $\mathrm{g} = \frac{STG + LTG}{2}$, short term growth rate, $(\gamma - 1) = r_f - 3\%$, the perpetual growth rate.	Ohlson and Juettner-Nauroth (2005)
MPEG	This model is a special case of OJ model. The model requires one-year ahead and two-year ahead earnings forecast and positive change in earnings forecast. After the explicit forecast horizon, the abnormal earnings constantly grows in perpetuity. $P_t = \frac{(FEPS_{t+2} + DPS_{t+1} \cdot k_{ES} - FEPS_{t+1})}{k_{ES}^2}$ where, k_{ES} = the implied cost of capital estimates, $FEPS_{t+i}$ = median analysts forecasts i-year ahead, DPS_{t+1} = the expected dividends per share in year t+1, equals to $FEPS_{t+1} \cdot d$, d_{t-1} = dividend payout ratio. Same definition as in the previous model,	Easton (2004)

Appendix B. Variable definitions

Variable	Definitions	Source
Accrual	Discretionary accruals component of total accruals estimated using the modified Jones model	Dechow, Sloan, and Sweeney (1995) Compustat, CRSP
Altman's Z	1.2*Working Capital/Total Assets + 1.4*Retained Earnings/Total Assets + 3.3*EBIT/Total Assets+ 0.6*Market value of Equity/Total Liabilities+0.999* Sales/Total Assets	Compustat
Analysts' forecast bias	Actual realized earnings minus one year ahead consensus forecast, scaled by stock price one-month prior the forecast announcement date	Compustat, CRSP, IBES
Analyst forecast dispersion	Standard deviation of one year ahead earnings per share forecast	IBES
Audit percentage	The ratio of the number of audit committee to the size of the board	ISS (Riskmetric)
Bank (Non-bank) connections	The number of executives and directors working or sitting on the boards of banks (non-banks) that the CEO is connected to via employment, university, and other social connections	Execucomp, Boardex
Beta	A proxy for the systematic risk of a firm. Estimated using the market model with daily returns over the 12 months prior to the time of cost of capital estimation	CRSP
Board network	The total number of executives and directors the board is connected to	Boardex
Board size	The number of directors sitting on the board	ISS (Riskmetric)
Book to market	Natural log of the book value of equity to the market value of equity	Compustat
Busy board	Dummy variable that takes the value of one if board is busy. Board is considered busy when the majority of independent directors serve on more than three outside public boards	Fich and Shivdasani (2006) ISS (Riskmetric)
CAPEX	Capital expenditure divided by lagged sales	Compustat
CEO cash compensation	Natural log of the sum of salary plus bonus	Execucomp
CEO connections	The number of executives and directors the CEO is connected to via professional connection, education connection, and social connection.	Engelberg *et al.* (2013) Execucomp, Boardex
CEO delta	The sensitivity of the CEO's equity portfolio to a 1% change in stock price	Coles *et al.* (2006) Execucomp
CEO-Dir Indicator	An indicator variable that equals to one if CEO is connected to at least one independent director on the board, and zero otherwise	Execucomp, Boardex
CEO-Independent Dir	The number of independent directors of his current company the CEO is connected to	Execucomp, Boardex
CEO ownership	The percentage of CEO's ownership in the firm	Execucomp

CEO title concentration	An indicator variable that equals to one if the CEO is both the chairman of the board and president, or the CEO is chairman and the firm does not have president or COO, and zero otherwise	Adams *et al.* (2005) Execucomp
CEO vega	The sensitivity of the CEO's equity portfolio to a 1% change in stock return volatility	Coles et al. (2006) Execucomp
CPS	CEO pay slice. CEO's total pay over the sum of the five highest paid executives' pay in a firm	Bebchuck *et al.* (2011) Execucomp
Customer-supplier (Non-customer-supplier) connections	The number of executives and directors working (not working) in customer or supplier industries that the CEO is connected to	Execucomp, Boardex
Earnings volatility	Standard deviation of earnings over the past 5 years. Earnings is defined as income before extraordinary items divided by the average of total assets of current and previous year	Dichev and Tang (2009) Compustat
Employment connections	The number of connections from the CEO's prior work and professional experience	Execucomp, Boardex
Few analysts	An indicator variable equals to one if the number of analysts following the firm is below the sample median for the year, and zero otherwise	IBES
Financier (Non-financier) connections	The number of executives and directors working in financier firms (non-financier firms) the CEO is connected to. Financier firms are the firms classified as 'banks', 'investment companies', 'private equity', or 'specialty and other finance' in Boardex.	Ferris *et al.* (2017), Execucomp, Boardex
Firm size	Natural log of market value of equity, adjusted for CPI to 2015 dollars	Compustat
Free-cash-flow	(Net cash flow from operating activities – cash dividends) divided by lagged total assets	Compustat
General ability index	Skills of CEOs that are transferrable across firms and industries. Common component extracted using principal components analysis from number of positions, number of firms, number of industries, CEO experience at other firm, CEO experience from conglomerate	Custódio *et al.* (2013) BoardEx, Execucomp, Compustat
High accrual	An indicator variable that equals to one if the accruals is higher than sample median for the year, and zero otherwise	Compustat
High audit	An indicator variable that equals to one if the percentage of audit committee to board size is higher than the sample median for the year, and zero otherwise	ISS (Riskmetrics)
High bid-ask	An indicator variable that equals to one if the bid-ask spread is higher than the sample median for the year, and zero otherwise	Corwin and Schultz (2012), CRSP
High CEO own.	An indicator variable that equals to one if the percentage of CEO ownership is above the sample median for the year and zero otherwise	Execucomp
High volatility	An indicator variable that equals to one if the stock return volatility is above sample median for the year and zero otherwise	CRSP
ICD	An indicator variable that equals to one if the firm has any internal control deficiencies and zero otherwise	Audit Analytics
Idiosyncratic risk	The standard deviation of the residual daily returns from the market model estimated with daily returns over the 12 months prior to the time of cost of capital estimation	CRSP

Implied cost of capital (ICOC)	The average of implied cost of capital. It is the mean value of four individual cost of capital estimates based on Clause and Thomas (2001), Gebhardt *et al.* (2001), Ohlson and Jeuttner(2005), and Easton (2004) minus the risk free rate that is the 10 year treasury yield on the month of cost of capital estimation	Compustat, CRSP, IBES
Implied cost of capital (ICOC) - HDZ	The average of four implied cost of capital measures that are estimated using earnings forecasted from running the following pooled cross-sectional regression. $E_{i,t+\tau} = \alpha_0 + \alpha_1 A_{i,t} + \alpha_2 DPT_{i,t} + \alpha_3 DP_{i,t} + \alpha_4 E_{i,t} + \alpha_5 Neg\ E_{i,t} + \alpha_6 ACC_{i,t,} + \varepsilon_{i,t,+\tau}$ where, $E_{i,t+\tau}$ = earnings of firm *i* in year t+τ, where τ ranges from one to five. Income before extraordinary items from Compustat, $A_{i,t}$ = total assets, $DPT_{i,t}$ = dividend payment, $DP_{i,t}$ = an indicator variable that equals to one if the firm pays dividends and zero otherwise, $Neg\ E_{i,t}$ = an indicator variable that equals to one for firms with negative earnings and zero otherwise, $ACC_{i,t}$ = accruals calculated using balance sheet method. We estimate the alphas of the cross-sectional model using previous ten years of data using the entire Compustat/CRSP universe. For each year's earnings, we use one to five years lagged independent variables to run five independent regressions and obtain five different sets of alpha coefficients. We obtain one to five years earnings forecasts by multiplying the most recent fiscal-year-end accounting variables with the alphas estimated from the regressions. We use this forecast estimates to compute the cost of capitals. Following Hou *et al.* (2012), we only require a firm to have at least one non-missing cost of capital estimates to compute the composite measure to maximize coverage.	Hou *et al.* (2012) Compustat, CRSP, IBES
Institutional ownership	The percentage of shares owned by institutional investors	Thomson Reuters, 13F
Intense monitor	An indicator variable that equals one when the majority of independent directors sit on two or more monitoring-intensive committees (audit, compensation, and nominating).	Faleye *et al.* (2011) ISS (Riskmetrics)
Ivy League	An indicator variable that equals to one if the CEO has attended an Ivy League school, and zero otherwise	Boardex
Ivy (Non-Ivy) League connections	The number of CEO's education connections established from Ivy (Non-Ivy) league schools, including undergraduate, masters, MBA, PhD, law, and other degrees	Execucomp, Boardex
Leverage	Ratio of long-term debt to the market value of equity	Compustat
Log (CAPEX)	Natural log of one plus *CAPEX*.	Compustat
Log (CEO age)	Natural log of CEO's age in years	Execucomp
Log (Firm age)	Natural log of the number of years since the firm first appeared in Compustat or CRSP, whichever is earlier	Compustat, CRSP
Log (R&D)	Natural log of one plus R&D expenses	Compustat

Log (Tenure)	Natural log of CEO tenure in years	Execucomp
Long-term growth	Analysts' long-term earnings growth forecast	IBES
Momentum	Natural log of one plus the compounded stock return over the previous 12 months	CRSP
Number of analysts	The number of analysts following and making forecasts	IBES
Number of blockholders	The number of blockholders that own more than 5% of firm's outstanding common shares	Thomson Reuters, 13F
Number of segments	The number of business segments of a firm	Compustat
Other social connections	The number of connections from the CEO's social activities. Included only if the individuals have 'active roles' other than mere membership, except clubs	Execucomp, Boardex
Overconfidence	An indicator variable that equals to 1 if a CEO holds options that are more than 67% in the money and zero otherwise	Execucomp
PPE	Property, plant, and equipment scaled by lagged sales	Compustat
Rival (Non-rival) connections	The number of executives and directors working in rival firms (non-rival firms) that the CEO is connected to via employment, university, and other social connections. Rival firms are defined as those in the same three-digit SIC industry as the focal firm	Execucomp, Boardex
Single insider	An indicator variable that equals to one if the CEO is the only insider director on a firm's board of directors, and zero otherwise	Execucomp
Small board	An indicator variable that equals to one if the board size is below the sample median for the year, and zero otherwise	ISS (Riskmetrics)
Small size	An indicator variable that equals to one if the firm size is smaller than the sample median for the year, and zero otherwise. Firm size is measured using the natural log of market value of equity.	Compustat
Standard deviation of ROA	Standard deviation of return on assets during the past five years Return on assets is defined as operating income before depreciation divided by total asset	Compustat
Stock return volatility	Standard deviation of the natural logarithm of daily returns over the past year	CRSP
University connections	The number of connections from the CEO's education, including undergraduate, masters, MBA, PhD, law, and other degree	Execucomp, Boardex

Appendix C. Endogeneity test – Controlling for additional variables

This table provides regression results from adding additional variables to the baseline regression and different fixed effects to test for the robustness of the findings. The dependent variable is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. *CEO connections* is the number of executives and directors that the CEO is connected to via employment, university, and other social connections. Column 1 controls for CEO-related variables. Column 2 controls for board-related variables and governance variables. Column 3 adds other firm-related variables. Column 4 controls for additional analyst-related variables. Column 5 includes all the additional control variables. Column 6 uses firm fixed effect instead of industry fixed effect. Column 7 adds CEO fixed effects to the baseline model. Column 8 uses industry-year fixed effect. All variable descriptions can be found in Appendix B. All independent variables are standardized to have mean zero and standard deviation one. All specifications include the control variables from Table 2 Column 3, year fixed effects, and industry fixed effects unless noted otherwise. Industries are defined at the 2-digit SIC level. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CEO connections	0.246***	0.123*	0.116**	0.219***	0.157***	0.356*	0.484*	0.232***
	(3.06)	(1.82)	(2.14)	(3.05)	(3.06)	(1.68)	(1.72)	(3.19)
Log(Tenure)	-0.160***				-0.076			
	(-2.88)				(-1.48)			
Log(CEO age)	0.077*				-0.044			
	(1.74)				(-0.84)			
CEO delta	0.009				-0.001			
	(0.07)				(-0.01)			
CEO vega	0.002				-0.002			
	(0.02)				(-0.04)			
CEO cash compensation	0.214***				0.148***			
	(3.27)				(2.72)			
General ability index	0.077				0.045			
	(1.34)				(1.02)			
Ivy League	-0.368***				0.011			
	(-2.81)				(0.07)			
Overconfidence	-0.408***				-0.170**			
	(-3.57)				(-2.10)			
Number of blockholders		-0.105			-0.094*			
		(-1.58)			(-1.84)			
Institutional ownership		-0.178***			-0.065			
		(-2.70)			(-0.87)			
Intense monitor		0.024			0.022			
		(0.46)			(0.46)			
Board size		0.291***			0.023			
		(3.78)			(0.33)			
Audit percentage		0.072			-0.009			
		(1.06)			(-0.17)			
CEO ownership		-0.133**			-0.074			
		(-2.55)			(-1.02)			
ICD		0.972			-0.257			
		(0.93)			(-1.20)			
CEO-Independent Dir		-0.100*			-0.063			
		(-1.84)			(-1.50)			
Board network		0.010			0.025			
		(1.39)			(0.47)			
CPS		-0.023			-0.054			

		(-0.54)			(-1.26)			
Single insider		0.090			0.129			
		(0.85)			(1.61)			
CEO title concentration		0.075			0.202*			
		(0.80)			(1.86)			
$Size^2$			1.393***		0.565			
			(3.32)		(1.15)			
Log(Firm age)			0.293***		0.188**			
			(4.42)		(2.50)			
Altman's Z			-0.320***		-0.261***			
			(-7.57)		(-4.35)			
PPE			-0.074***		-0.050			
			(-3.28)		(-1.39)			
CAPEX			0.036*		-0.000			
			(1.90)		(-0.01)			
Log (R&D)			0.085		0.106			
			(1.02)		(1.40)			
Standard deviation of ROA			0.315***		0.374***			
			(6.73)		(7.29)			
Accrual			0.004		0.045			
			(0.09)		(0.89)			
Number of segments			0.011		0.003			
			(0.21)		(0.05)			
Free-cash-flow			-0.294***		-0.275***			
			(-4.71)		(-4.16)			
Number of analysts				-0.142**	-0.036			
				(-2.16)	(-0.48)			
Analyst forecast bias				-0.523***	-0.257***			
				(-4.80)	(-4.26)			
Observations	8,696	6,737	7,196	10,507	4,005	10,507	10,507	10,507
Adjusted R-squared	0.434	0.504	0.445	0.417	0.575	0.747	0.838	0.418

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Table 1. Summary statistics

This table provides the summary statistics of dependent and independent variables. All continuous control variables are winsorized at the 1st and 99th percentiles. Panel A shows the summary statistics for the CEO connections while Panel B provides the statistics for variables relating to the costs of equity and other control variables. The sample consists of 10,507 firm-year observations from 2003 to 2014. *Cost of capital – Mean* is the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) subtracted by the 10-year treasury yield. *Cost of capital – HDZ* is the implied cost of capital estimates calculated following Hou *et al.* (2012). *CEO connections* is the number of directors and executives with whom the CEO is connected to via employment, university, or social connections. *Employment connections* is the number of CEO's pre-existing connections from his previous job positions; *Education connections* is the number of CEO's connections from educational institutions; and *Other social connections* is the number of connections from charities, clubs etc. *Firm size* is the natural log of market value of equity. *Book to market* is the natural log of book value of equity to market value of equity. *Leverage* is long-term debt divided by the market value of equity. *Momentum* is the natural log of one plus the compounded stock return over the previous 12 months. *Beta* is estimated from the market model regressing daily stock returns over the prior 12 months on the corresponding CRSP value-weighted market returns. *Idiosyncratic risk* is the standard deviation of the residuals from the market model. *Forecast dispersion* is the standard deviation of one year ahead earnings per share forecast. *Long-term growth* is the long-term growth rate forecasted by analysts.

	Mean	S.D.	P25	Median	P75
Panel A. CEO connections					
CEO connections	135.048	153.199	37.000	75.000	170.000
- Employment connections	52.761	59.568	23.000	37.000	59.000
- Education connections	9.104	20.251	0.000	0.000	10.000
- Other social connections	72.286	117.568	1.000	23.000	89.000
Panel B. Cost of equity variables and controls					
Cost of capital - Mean	5.745	3.812	3.729	5.255	7.022
Cost of capital - CT	4.377	3.209	2.549	4.052	5.745
Cost of capital - GLS	4.030	2.808	2.125	3.824	5.565
Cost of capital - OJ	7.341	3.473	5.093	6.788	8.858
Cost of capital - MPEG	6.840	4.137	4.199	6.154	8.597
Cost of capital – HDZ	6.479	6.290	2.793	4.951	8.360
Firm size	8.123	1.465	7.040	7.966	9.085
Book to market	-0.934	0.650	-1.313	-0.875	-0.486
Leverage	0.278	0.386	0.022	0.149	0.367
Momentum	0.111	0.290	-0.050	0.125	0.280
Beta	1.024	0.364	0.757	0.996	1.255
Idiosyncratic risk	0.017	0.008	0.012	0.016	0.021
Forecast dispersion	0.081	0.105	0.030	0.050	0.090
Long-term growth	13.398	6.410	10.000	12.500	15.750

Table 2. CEO connections and cost of equity

This table provides regression results relating CEO connections to the cost of equity capital for 10,507 firm-year observations from 2003 to 2014. The dependent variable in Columns 1 to 3 is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. The dependent variables in Columns 4 to 7 are the cost of capital estimates, in excess of the risk-free rate, from CT, GLS, OJ, and MPEG respectively. Column 8 uses the implied cost of capital following Hou *et al.* (2012) as the dependent variable. *CEO connections* is the number of executives and directors that the CEO is connected to via employment, university, and other social connections. All other variable descriptions can be found in Appendix B. All independent variables are standardized to have mean zero and standard deviation one. All specifications include year fixed effects and industry fixed effects. Industries are defined at the 2-digit SIC level. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	Dependent variable =							
	Cost of capital – Mean			CT	GLS	OJ	MPEG	HDZ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CEO connections	0.232***	0.227***	0.223***	0.238***	0.062	0.300***	0.293***	0.669***
	(3.16)	(3.08)	(3.03)	(2.70)	(0.78)	(4.51)	(3.29)	(7.83)
Firm Size	-0.192***	-0.057	-0.008	0.115	0.027	-0.059	-0.116	-2.626***
	(-2.59)	(-0.76)	(-0.10)	(1.21)	(0.34)	(-0.63)	(-1.20)	(-20.43)
Book to market	0.433***	0.425***	0.436***	0.338***	0.775***	0.238***	0.395***	0.0628
	(7.96)	(7.83)	(7.98)	(5.65)	(11.62)	(3.26)	(5.69)	(0.59)
Leverage	0.570***	0.512***	0.496***	0.481***	0.340***	0.633***	0.530***	0.765***
	(8.18)	(7.45)	(7.20)	(6.34)	(5.39)	(7.45)	(5.71)	(6.23)
Momentum	-0.736***	-0.753***	-0.746***	-0.695***	-0.529***	-0.910***	-0.849***	-0.934***
	(-18.67)	(-19.31)	(-18.76)	(-15.03)	(-16.14)	(-17.85)	(-14.81)	(-11.68)
Forecast dispersion	1.210***	1.179***	1.168***	1.208***	1.026***	1.020***	1.416***	0.363***
	(6.40)	(6.22)	(6.10)	(5.43)	(5.28)	(6.82)	(6.33)	(3.92)
Long-term growth	0.344***	0.290***	0.266***	0.362***	-0.111*	0.508***	0.305***	-0.418***
	(5.65)	(4.66)	(4.11)	(4.87)	(-1.76)	(7.10)	(3.91)	(-5.10)
Beta		0.410***	0.355***	0.289***	0.201***	0.357***	0.574***	0.0628
		(8.77)	(7.51)	(5.17)	(4.59)	(6.09)	(8.82)	(0.55)
Idiosyncratic risk			0.163**	0.074	0.056	0.054	0.469***	0.924***
			(2.23)	(0.89)	(0.82)	(0.54)	(4.85)	(6.01)
Observations	10,507	10,507	10,507	10,507	10,507	10,507	10,507	10,495
Adjusted R-squared	0.392	0.399	0.400	0.310	0.402	0.326	0.363	0.322

Table 3. Regression with alternative specifications of CEO connections

This table reports results using alternative specifications for CEO connections. The dependent variable is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. *CEO connections* is the number of executives and directors that the CEO is connected to via employment, university, and other social connections. *Residual CEO connections* is the residual from regressing *CEO connections* on firm size. Column 2 uses the natural log of *CEO connections* as the main independent variable. Column 3 uses the percentile rank of *CEO connections* as the main independent variable. Column 4 uses the scaled percentage of *CEO connections*, which is the number of CEO connections divided by the total of connections across all CEOs for a given year, as the main independent variable. All independent variables are standardized to have mean zero and standard deviation one. All specifications include the control variables listed in Table 2 Column 3, year fixed effects, and industry fixed effects. Industries are defined at the 2-digit SIC level. All variable descriptions can be found Appendix B. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)
Residual CEO connections	0.181***			
	(3.03)			
Log(CEO connections)		0.129**		
		(2.09)		
Percentile CEO connections			0.128**	
			(2.19)	
Scaled CEO connections				0.098*
				(1.79)
Controls	Yes	Yes	Yes	Yes
Observations	10,507	10,507	10,507	10,507
Adjusted R-squared	0.400	0.398	0.398	0.398

Table 4. Endogeneity test: Propensity score matching

This table presents results for the propensity score matched sample analysis where firms in the above median *CEO connections* are matched to firms in the below median group. The matching starts with a logit regression in which the dependent variable is an indicator equals one if the firm-year falls in the above median *CEO connections* group and zero otherwise. We use two sets of matching covariates – the first set consists of the explanatory variables in the baseline regression in Table 2, Column 3, the second set further includes CEO characteristics and CEO pay structure. Then, using the estimated predicted probabilities from the logit regressions, we match to each high *CEO connections* observation a low *CEO connections* observation. We employ kernel matching and one-to-one nearest neighbor matching without replacement. The match is done within the same industry and same year. Panel A reports the mean comparison of covariates for the matching specification that includes additional CEO matching covariates and using kernel matching with bandwidth of 0.0005. Panel B compares the average cost of equity for the high *CEO connections* group and low *CEO connections* group matched using various matching methods and specifications. (1) compares the cost of equity for the samples matched using kernel matching with bandwidth 0.00025 and without CEO covariates. (2) compares the cost of equity for the samples matched using kernel matching with bandwidth of 0.0005 and including CEO characteristics as additional matching covariates. (3) compares the cost of equity for the samples matched using one-to-one nearest neighbor matching without replacement and without additional CEO covariates and we require the propensity score to be within +/- 0.0085 of each other. (4) compares the cost of equity for the samples matched using one-to-one nearest neighbor matching without replacement with additional CEO covariates and require the propensity score of each matched pair to be within +/- 0.025 of each other. The *t*-statistics tests whether the difference between the two groups of firms are significantly different from zero. Industries are defined at 2-digit SIC level. All matching covariates are standardized to have mean zero and standard deviation one. All variable descriptions can be found in Appendix B. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A. Covariate comparison

Variable	High Conn.	Low Conn.	Diff.	*t*-statistics
Propensity score	0.5118	0.5116	0.0002	0.02
Firm size	-0.0188	-0.0421	0.0232	0.68
Book to market	0.0498	0.0657	-0.0159	-0.38
Leverage	-0.0050	0.0279	-0.0328	-0.82
Momentum	0.0092	-0.0217	0.0309	0.78
Analyst forecast dispersion	-0.0797	-0.0749	-0.0048	-0.13
Long-term growth	-0.0715	-0.0738	0.0023	0.06
Beta	-0.0263	-0.0713	0.0450	1.11
Idiosyncratic risk	-0.0929	-0.1024	0.0094	0.25
Log (Tenure)	-0.0182	0.0147	-0.0329	-0.82
Log (CEO age)	-0.0197	-0.0935	0.0738	1.76*
CEO delta	-0.0939	-0.0609	-0.0330	-1.12
CEO vega	0.0351	0.0090	0.0260	0.59
Cash compensation	0.0014	-0.0210	0.0225	0.61
General ability index	0.0653	0.0334	0.0319	0.76
Ivy	0.0934	0.0970	-0.0036	-0.29
Overconfidence	0.3345	0.3287	0.0058	0.29

Panel B. Test of difference in cost of equity for matched samples

Cost of equity (1)	5.7710	5.4113	0.3597	2.28**
Cost of equity (2)	5.7359	5.3785	0.3574	2.40**
Cost of equity (3)	5.7009	5.3569	0.3440	1.95*
Cost of equity (4)	5.7331	5.4124	0.3207	2.04**

Table 5. Endogeneity test: Test of causality around CEO turnover

This table presents the results of difference-in-difference tests to address reverse causality concerns. We focus on the time surrounding CEO turnovers, where Year *T* is the year containing the turnover. Panels A to D examine how future cost of equity changes when CEO network size changes due to turnover events. Panel A looks at the cost of capital change from *T* to *T*+1 and Panel B from *T* to *T*+2. Panel C looks at the cost of capital change from *T-1* to *T*+1 and Panel D from *T-1* to *T*+2. The sample of turnovers are divided into four quartiles based on the change in *CEO connections* from *T*-1 to *T*. Panel E presents the effect of implied cost of capital changes from *T*-2 to *T*-1 on CEO's connections changes arising from CEO turnover. All variable descriptions can be found in Appendix B. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A: Effect of CEO connections change (*T*-[*T*-1]) on future change in cost of equity ([*T*+1] – *T*)

Dependent variable: Δ Cost of Capital ([*T*+1] -*T*)				
CEO connections change quartile groups	Obs	Mean	Diff-in-Diff	T-Stat
Δ CEO's connections (*T*-[*T*-1]) ≤ 25%	135	-0.1830	0.0027	0.0097
Δ CEO's connections (*T*-[*T*-1]) ≥ 75%	134	-0.1803		

Panel B: Effect of CEO connections change (*T*-[*T*-1]) on future change in cost of equity ([*T*+2] – *T*)

Dependent variable: Δ Implied Cost of Capital ([*T*+2] -*T*)				
CEO connections change quartile groups	Obs	Mean	Diff-in-Diff	T-Stat
Δ CEO's connections (*T*-[*T*-1]) ≤ 25%	101	-0.2885	0.6946	1.9624**
Δ CEO's connections (*T*-[*T*-1]) ≥ 75%	104	0.4062		

Panel C: Effect of CEO connections change (*T*-[*T*-1]) on future change in cost of equity ([*T*+1] – [*T*-1])

Dependent variable: Δ Cost of Capital ([*T*+1] –[*T*-1])				
CEO connections change quartile groups	Obs	Mean	Diff-in-Diff	T-Stat
Δ CEO's connections (*T*-[*T*-1]) ≤ 25%	98	-0.2583	0.5688	1.5416
Δ CEO's connections (*T*-[*T*-1]) ≥ 75%	97	0.3106		

Panel D: Effect of CEO connections change (*T*-[*T*-1]) on future change in cost of equity ([*T*+2] – [*T*-1])

Dependent variable: Δ Implied Cost of Capital ([*T*+2] –[*T*-1])				
CEO connections change quartile groups	Obs	Mean	Diff-in-Diff	T-Stat
Δ CEO's connections (*T*-[*T*-1]) ≤ 25%	63	0.1795	1.0218	2.1105 **
Δ CEO's connections (*T*-[*T*-1]) ≥ 75%	75	1.2013		

Panel E: Effect of past cost of capital change ([*T*-1]-[*T*-2]) on change in CEO connections (*T*-[*T*-1])

Dependent variable: Δ CEO's connections (*T*-[*T*-1])				
Cost of capital change quartile groups	Obs	Mean	Diff-in-Diff	T-Stat
Δ Implied Cost of Capital ([*T*-1]-[*T*-2]) ≤ 25%	115	-11.2261	9.5202	0.4961
Δ Implied Cost of Capital ([*T*-1]-[*T*-2]) ≥ 75%	119	-1.7059		

Table 6. Additional tests – Individual CEO connections components

This table shows the regression results of regressing the cost of equity on the various types of CEO connections. The dependent variable is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. *Employment connections* is the number of CEO's pre-existing connections from his previous job position. *Education connections* is the number of CEO's connections from educational institution. *Other social connections* is the number of connections from charities, clubs etc. *Non-Ivy League connections* is the number of CEO's education connections arising from non-Ivy League educational institution. *Ivy League connections* is the number of CEO's education connections arising from Ivy League educational institution. All independent variables are standardized to have mean zero and standard deviation one. All specifications include the control variables from Table 2 Column 3, year fixed effects, and industry fixed effects unless noted otherwise. Industries are defined at the 2-digit SIC level. All variable descriptions can be found in Appendix B. *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Employment connections	0.229**			0.213**			
	(2.50)			(2.28)			
Education connections		-0.138***		-0.162***			
		(-2.68)		(-3.09)			
Other social connections			0.179***	0.172**			
			(2.69)	(2.52)			
Non-Ivy League connections					-0.027		-0.042
					(-0.44)		(-0.69)
Ivy League connections						-0.125***	-0.130***
						(-2.83)	(-2.89)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,507	10,507	10,507	10,507	10,507	10,507	10,507
Adjusted R-squared	0.400	0.399	0.399	0.403	0.398	0.399	0.399

Table 7. Additional tests – Support for agency channel

This table shows the cross-sectional regression results by governance measures. The dependent variable is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. CEO connections is the number of executives and directors that the CEO is connected to via employment, university, and other social connections. *Intense monitor* is an indicator variable equals to one if the majority of independent directors serves on at least two of three monitoring intensive committee (audit, compensation, and nominating) following Faleye *et al.* (2011), and zero otherwise. *Small board* is an indicator variable equals to one if the board size is smaller than the median for the year, and zero otherwise. *High audit* is an indicator variable equals to one if the number of audit committee members to board size is greater than the median for the year, and zero otherwise. *High CEO own.* is an indicator variable equals to one if the CEO ownership percentage is greater than the median for the year, and zero otherwise. *ICD* is an indicator variable that equals to one if the firm has any internal control deficiencies, and zero otherwise. *CEO-Dir Indicator* is an indicator variable equals to one if the CEO is socially connected to at least one independent director on the board and zero otherwise. All variable descriptions can be found in Appendix B. All continuous independent variables are standardized to have mean zero and standard deviation one. All specifications include the control variables listed in Table 2 Column 3, year fixed effects, and industry fixed effects unless noted otherwise. Industries are defined at 2-digit SIC level. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
CEO connections (a)	0.262***	0.207***	0.297***	0.330***	0.209***	0.242***
	(3.81)	(2.77)	(3.52)	(3.79)	(2.70)	(3.02)
Intense monitor	-0.093					
	(-0.87)					
(a) X Intense monitor	-0.486***					
	(-2.78)					
Small board		-0.300***				
		(-3.19)				
(a) X Small board		-0.255**				
		(-2.17)				
High audit			0.033			
			(0.41)			
(a) X High audit			-0.310**			
			(-2.37)			
High CEO own.				-0.429***		
				(-4.33)		

(a) X High CEO own.				-0.273**		
				(-2.17)		
ICD					0.561	
					(0.84)	
(a) X ICD					0.820	
					(0.84)	
CEO-Dir Indicator						-0.021
						(-0.43)
(a) X CEO-Dir Indicator						-0.037
						(-1.35)
Observations	8,552	8,552	7,183	10,395	10,507	10,507
Adjusted R-squared	0.446	0.445	0.499	0.405	0.401	0.400

Table 8. Additional tests - Removal of ATP and subsample by CEO connections

This table reports the regression-discontinuity design for the removal of anti-takeover provisions following Cuñat *et al.* (2012). The dependent variable is *Cost of capital – Mean,* the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. The independent variable *Pass* is an indicator variable that equals to one if the shareholder's proposal to remove the anti-takeover provision has received more than the threshold percentage of vote, and zero otherwise. Polynomials up to 2nd order are included in the regression specification. Column 1 uses the entire sample. Column 2 uses the group of firms with below median *CEO connections*. Column 3 shows the result for the group of firms with above median *CEO connections*. All specifications include year fixed effect. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses.*, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	Full Sample	Low CEO connections	High CEO connections
	(1)	(2)	(3)
Pass	-0.792*	-1.122*	-0.268
	(-1.95)	(-1.92)	(-0.48)
Controls	No	No	No
Polynomials	2	2	2
Year Fixed Effects	Yes	Yes	Yes
Observations	1,292	650	642
Adjusted R^2	0.086	0.111	0.065

Table 9. Additional tests - Support for risk-taking channel

This table provides evidence in support of the risk-taking channel impact of CEO connections. In Panel A, we divide the sample into two groups based on the median age of the CEOs and run the baseline regression in Table 2 Column 3. The *Chi*^{2} test whether the coefficients of *CEO connections* are significantly different across the two subsamples. Panel B shows the regression results where cost of equity is regressed on the CEO's connections to rival firms, non-rival firms, customer-supplier firms, and non-customer-suppler firms. The regression specification follows that in Table 2 Column 3. *Rival connections* (*Non-rival connections*) is the number of executives and directors working in rival firms (non-rival firms) that the CEO is connected to via employment, university, and other social connections. Rival firms are defined as those in the same three-digit SIC industry as the focal firm. *Customer-supplier connections* (*Non-customer-supplier connections*) is the number of executives and directors working (not working) in customer or supplier industries that the CEO is connected to via employment, university, and other social connections. Panel C shows results where we regress proxies for risk-taking against *CEO connections*. The risk-taking proxies are rescaled to show less decimal points. The control variables include the ones used in Table 2 Column 1 where systematic and unsystematic risks are excluded. Panel D presents the regression results for long-term tenured CEOs on cost of capital. All variable descriptions can be found in Appendix B. All independent variables are standardized to have mean zero and standard deviation one, except for the main independent variables in Panel B. All specifications include the control variables listed in Table 2 Column 3, year fixed effects, and industry fixed effects unless noted otherwise. Industries are defined at 2-digit SIC level. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A. Impact of CEO age

	(1) Young CEOs		(2) Old CEOs
CEO connections	0.343***		0.127*
	(3.81)		(1.66)
Chi^2		7.7***	
Observations	4,926		5,581
Adjusted R-squared	0.412		0.398

Panel B. CEO connections to competitors/customer-suppliers

	(1)	(2)	(3)	(4)	(5)	(6)
Rival connections	0.012***		0.007**			
	(3.30)		(2.16)			
Non-rival connections		0.001**	0.001**			
		(2.93)	(2.42)			
Customer-supplier connections				0.024***		0.019**
				(3.50)		(2.69)
Non-customer-supplier connections					0.001**	0.001*
					(2.87)	(1.95)
Chi^2	10.01***			11.42***		
F-Statistics			3.05*			6.17**
Observations	10,507	10,507	10,507	10,507	10,507	10,507
Adjusted R-squared	0.399	0.400	0.400	0.400	0.400	0.401

Panel C. CEO connections and risk-taking behavior

	Stock Return Volatility (x100)	**Earnings Volatility (x100)**	**Log (R&D)**	**Log (CAPEX) (x100)**	**Accrual (x100)**	**Systematic Risk (x100)**	**Idiosyncratic Risk (x100)**
CEO connections	0.024**	0.196**	0.201***	-0.298**	0.203**	0.395	0.027***
	(2.31)	(2.54)	(4.25)	(-2.33)	(2.33)	(0.74)	(2.73)
Observations	10,507	9,654	10,507	10,507	9,054	10,507	10,507
Adjusted R-squared	0.674	0.170	0.676	0.508	0.050	0.383	0.576

Panel D. Separating by CEO tenure

	(1) CEO Tenure > 4 Years	(2) CEO Tenure > 6 Years
CEO connections	0.191***	0.141**
	(2.67)	(2.02)
Observations	6,939	5,236
Adjusted R-squared	0.407	0.433

Table 10. Additional tests – Support for information asymmetry channel

This table presents the results supporting information asymmetry channel of CEO connections. Panel A shows the cross-sectional regression results by information asymmetry measures. The dependent variable is *Cost of capital – Mean*, the average of implied cost of capital estimates calculated following the four methodologies presented in Claus and Thomas (2001) (CT), Gebhardt *et al.* (2001) (GLS), Easton (2004) (MPEG), and Ohlson and Juettner-Nauroth (2005) (OJ) and is in excess of the 10-year treasury yield. CEO connections is the number of executives and directors that the CEO is connected to via employment, university, and other social connections. *Small size* is an indicator variable equals to one if the market value of equity is below the sample median for the year, and zero otherwise. *High accrual* is an indicator variable equals to one if the accrual is higher than sample median for the year and zero otherwise. *High bid-ask* is an indicator variable equals to one if the bid-ask spread is higher than the sample median for the year, and zero otherwise. *Few analysts* is an indicator variable equals to one if the number of analysts following the firm is below the sample median for the year, and zero otherwise. *High volatility* is an indicator variable equals to one if the stock return volatility is above sample median for the year, and zero otherwise. Panel B shows the regression results for bank (non-bank) connections and financier (non-financier) connections as the explanatory variable. *Bank (non-bank) connections* are CEO connections to executives and directors working (not working) in the banking industry. *Financier (non-financier) connections* are CEO connections to executives and directors working (not working) in the firms classified as 'banks', investment companies', 'private equity', or 'specialty and other finance' in Boardex. All variable descriptions can be found in Appendix B. All independent variables are standardized to have mean zero and standard deviation one. All specifications include the control variables listed in Table 2 Column 3, year fixed effects, and industry fixed effects unless noted otherwise. Industries are defined at 2-digit SIC level. The *t*-statistics with standard errors clustered at the firm level are reported in parentheses. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Panel A. Cross-sectional regression results by information asymmetry measures

	(1)	(2)	(3)	(4)	(5)
CEO connections: (a)	0.344***	0.272***	0.316***	0.304***	0.304***
	(4.01)	(3.07)	(4.29)	(3.60)	(3.49)
Small size	-0.124				
	(-0.72)				
(a) X Small size	-0.458***				
	(-3.57)				
High accrual		0.169***			
		(2.61)			
(a) X High accrual		-0.073			
		(-1.06)			
High bid-ask			0.106		
			(1.46)		
(a) X High bid-ask			-0.276**		
			(-2.10)		
Few analysts				0.175*	
				(1.83)	
(a) X Few analysts				-0.231**	
				(-2.00)	
High volatility					0.014
					(0.14)
(a) X High volatility					-0.266**
					(-1.97)
(a) + Interaction (*p*-value)	0.2956	0.0059	0.7598	0.4806	0.7352
Observations	10,507	9,057	10,277	10,507	10,507
Adjusted R-squared	0.402	0.445	0.406	0.401	0.401

Panel B. Bank (non-bank) connections

	(1)	(2)	(3)	(4)
Bank connections	0.119	-0.635*		
	(0.74)	(-1.79)		
Non-bank connections	0.083	0.801**		
	(0.57)	(2.05)		
Financier connections			0.150	0.358
			(1.16)	(1.63)
Non-financier connections			0.079	-0.063
			(0.69)	(-0.26)
Firm FE	No	Yes	No	Yes
Industry FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
Observations	10,507	10,507	10,507	10,507
Adjusted R-squared	0.399	0.748	0.400	0.747