Do Better Connected Executives Have Longer Incentive Horizon? *

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Abstract

I investigate the effect of executive connections on the horizon of managerial incentives. By using a comprehensive sample of more than 9,000 executives in S&P 1500 firms from 2000 through 2012, I construct measures for incentive horizon and executive connections. Consistent with prior literature that executives with larger networks have less career concerns and more access to information spillovers, I find that more executive connections induce longer incentive horizon. Further tests with instrumental variable regressions confirm this finding. It implies that network connections not only affect the horizon of executive pay but also may be linked to corporate long-term growth through incentive horizon.

Keywords: social networks, executive compensation, pay duration, incentive horizon

JEL classification: G30, G34, J33, L14

1. Introduction

The recent financial crisis has reignited interest in the importance of executive incentive horizon in fostering long-term growth in corporations. While long-term compensation contracts may mitigate managerial myopia, executives are often unwilling to accept compensation incentives that have long horizon because it may increase their exposure to turnover risk. The board may also find long-term managerial compensation less desirable when the firm needs to compensate executives for their willingness to receive long-horizon incentives. While prior studies have shown that executive pay with long horizon achieves long-term firm performance and mitigates managerial short-termism, it is crucial to investigate what factors can induce both executives and the board to accept long horizon of managerial incentives.

Prior literature has established that executives with more network connections benefit their firms because of better access to information via their networks (e.g., Fracassi 2014; Engelberg, Gao, and Parsons 2012; Faleye, Kovacs, and Venkateswaran 2013). Better connected CEOs are also more likely to find new and better jobs after forced turnovers, have more outside employment options, and have higher compensation (e.g., Nguyen 2012; Liu 2014; Engelberg, Gao, and Parsons 2013). Taken together, existing studies suggest that while larger networks reduce the turnover risk or make turnovers less costly to executives, the firm also value their potential access to information spillover through networks. Therefore, my goal is to contribute to the literature on incentive horizon and social networks by investigating whether and how executive connections may affect the horizon of managerial incentives and has potential implications on corporate long-term performance.

To test the hypothesis that better connected executives have longer incentive horizon, I construct measures of incentive horizon and executive connections in a sample of more than

9,000 executives in S&P 1500 firms from 2000 through 2012. Consistent with recent paper (e.g., Gopalan, Milbourn, Song, and Thakor 2013; Engelberg, Gao, and Parsons 2013), I use the duration of executive compensation to measure incentive horizon, and I use the total number of executive connections to measure the executive's network centrality. I find strong evidence that better connected executives have significantly longer horizon of compensation incentives. To mitigate the endogeneity concern due to omitted variables, I explore variations in past employment and education history to construct instruments for executive connections. In instrumental variable regressions, I show that network connectedness of an executive significantly and positively affect her incentive horizon. In sum, I provide strong empirical evidence that executive connection is an important factor that induces long horizon of managerial incentives.

I contribute to three distinct sets of literature. First, I contribute to the literature on managerial incentive horizon. Recent paper by Gopalan, Milbourn, Song, and Thakor (2013) document important firm characteristics that determine incentive horizon, and I extend their paper by focusing on managerial characteristics, i.e. network connections, that play crucial roles in managerial career concerns and information spillovers. Second, I also contribute to the literature on the effect of social networks on executive compensation. Engelberg, Gao, and Parsons (2013) find that CEOs with larger networks have higher compensation, and I complement their study by documenting executive connections not only affect *how much* executives are paid but also change *how* they are paid. Third, I contribute to the literature on corporate long-term growth by providing a potential channel that links executive connections to long-term firm performance. Building on recent papers that show longer incentive horizon help firms alleviate managerial short-termism (e.g., Gopalan, Milbourn, Song, and Thakor 2013;

Cadman and Sunder 2014; Cheng, Cho, and Kim 2014), my findings imply that executive connections may facilitate long-term firm growth via the channel of incentive horizon.

The paper proceeds as follows. In Section 2 I relate the study to the existing literature and develop hypotheses. In Section 3 I describe the data and specifications. In Section 4 I discuss the findings. I conclude in Section 5.

2. Background and Hypothesis Development

Prior studies argue that executive pay with long horizon links compensation to long-term firm performance and thus mitigates managerial short-termism (e.g., Bebcuk and Fried, 2010; Bhagat and Romano, 2010). Subsequently, an emerging literature has built theoretical frameworks for the optimal incentive horizon, and the general view is that equity awards with long vesting periods alleviate managerial short-termism (e.g., Bolton, Scheinkman, and Xiong, 2006; Manso, 2011; Peng and Roell, 2014; Edmans, Gabaix, Sadzik, and Sannikov, 2012)[1]. Gopalan, Milbourn, Song, and Thakor (2013) use pay duration - the weighted average of vesting periods of different pay components - to measure incentive horizon, and find that longer pay duration is negatively associated with the extent of earnings-increasing accruals. Baranchuk, Kieschnick, and Moussawi (2014) show that, in a sample of newly public firms, corporations become more innovative after they award the CEO equities with longer vesting periods. They conclude that this finding is consistent with the theoretical prediction that equity awards with longer vesting periods provide executives with better incentives to pursue long-term objectives. While the growing literature has focused on the economic outcomes and firm characteristics that

[1] Laux (2012) show that equity awards with early vesting can be part of an optimal contract if an executive is concerned about dismissal risk and rely on short-term performance as feedback about her talent.

are related to managerial incentive horizon, few paper attempts to investigate the effect of individual attributes on pay duration.[2]

One crucial individual attribute for top executives is their network connectedness. Top executives in Corporate America are linked to high-ranking managers or directors at other firms through professional, educational, and social networks, and these networks have been shown to have significant effects on economic outcomes, both at the individual level and the firm level. At both levels, one fundamental advantage of networks is that information flows across network nodes and creates knowledge spillovers (e.g., Glaeser et al. 1992; Jaffe, Trajtenberg, and Henderson 1993), meaning that information generated in one part of the network becomes accessible to other nodes.

The executive's network may accrue value to the firm. For example, Fracassi (2014) show that external networks help the firm obtain information advantages to improve its investment decisions, and firms that are more central in the networks exhibit better performance. Engelberg, Gao, and Parsons (2012) find that when banks and firms have managers interconnected through professional or education networks interest rates are significantly reduced. They show that firms with connected deals subsequently improve performance in future credit ratings or stock returns, implying that networks lead to knowledge spillovers. Faleye, Kovacs, and Venkateswaran (2013) document that firms with more-connected CEOs invest more in R&D, and these firms obtain more and better patents. They conclude that external networks confer the firm better access to information and alleviate career concerns of executives in risk investments. Cohen, Frazzini, and Malloy (2008) use educational connections between mutual fund managers and corporate directors to identify information transfer in security markets. They

[2] For recent studies that related individual attributes to investment decisions, productivity, and compensation level, see Bertrand and Schoar (2003); Schoar (2007); Malmendier and Tate (2009); Kaplan, Klebanov, and Sorensen (2012).

find that portfolio managers invest more on connected firms and perform significantly better relative to their non-connected holdings. Overall, these papers suggest that networks may be an important mechanism for information spillovers among organizations and appear to be valuable to the firm.

Networks may also benefit individuals with connections. For instance, Nguyen (2012) find that the CEO with social connections to directors is less likely to dismissed for underperformance and more likely to find new and better jobs after a forced turnover. Liu (2014) study the network effect on the labor market conditions for CEOs. She concludes that the CEO's connectedness expands outside employment options and reduces job search frictions. Engelberg, Gao, and Parsons (2013) document that CEOs with larger networks have higher compensation. They show that the wage premium for connections is consistent with literature on the information spillovers of the network, whereby CEOs are compensated for their valuable and portable network connections that facilitate knowledge flow into the firm. Cohen, Frazzini, and Malloy (2010) find that stock analysts outperform significantly on their stock recommendations for the firm where they have educational link to the senior executives. Cohen, Frazzini, and Malloy (2010) conclude that analysts gain superior information through their social networks, and the information advantage benefits them on stock recommendations. To sum up, prior studies support that executives with large networks obtain comparative advantage that alleviate their career concerns and facilitate better personal performance, and hence networks appear to be valuable to executives.

While recent papers on networks have studied on economic outcomes at the firm level and the individual level, no paper, to the best of my knowledge, has focused on the network effect on the executive's incentive horizon. Network connectedness may affect pay horizon from

both the manager's perspective and the board's perspective. On one hand, the board may prefer awarding long-term contracts to retain the executive for continuous access to valuable information through her network. In particular, the board may use long vesting periods to reward managers for their long-term success and at the same time increase the cost of early voluntary departure for executives (e.g., Gopalan, Milbourn, Song, and Thakor 2013). On the other hand, previous review on literature has shown that networks expand outside options for executives and thus alleviate their dismissal risk. Previous papers have documented CEOs bear significant costs in forced turnovers. For example, Peters and Wagner (2013) show that turnover risk is priced in executive compensation. They document a significantly positive association between turnover risk and CEO pay. High turnover risk increases the probability for the executive to leave the firm early, and thus makes the compensation contract with long vesting periods less desirable to the executive. Laux (2012) also show that dismissal risk is a major friction that makes long vesting periods costly to managers.

Therefore, in equilibrium, the executive's connectedness may be an effective contracting factor that leads to long incentive horizon. Better connected executives may benefit the firm by providing access to valuable information, so the board awards compensation with longer vesting periods to retain the executive. Larger networks reduce the executive's dismissal risk by providing outside options and hence labor market insurance, so compensation with long vesting periods becomes less costly to better connected executives. To sum up, I expect the executive's incentive horizon to be positively associated with her network connectedness.

3. Data and Specifications

3.1 Data Construction

To measure executive connections, I obtain network connection data from BoardEx. BoardEx is a business intelligence database that provides detailed profiles of over 400,000 of the world's business leaders in over 14,800 public and large private companies in North America and Europe. BoardEx uniquely provides in-depth biographical information about directors and executives, including complete employment record, education background, professional qualifications, and non-business-related activities. Based on these detailed biographical information, network connectedness can be measured by constructing networks among executives and directors via their shared common histories in employment and education. Consistent with prior studies (e.g., Engelberg, Gao, and Parsons 2013; Faleye, Kovacs, and Venkateswaran 2013), I measure executive network connectedness by the total number of individuals with whom the executive shares a common employment or educational history in BoardEx, which excludes those individuals who are employed by the executive's current firm.

Recent paper by Gopalan, Milbourn, Song, and Thakor (2013) propose to measure incentive horizon by the weighted average duration of four components of compensation (salary, bonus, restricted stock, and stock option). Following their specification in Equation (1) of Gopalan, Milbourn, Song, and Thakor (2013), I measure incentive horizon by *Incentive duration* in the equation below:

$$\textit{Incentive duration} = \frac{(Salary+Bonus)\times 0 + \sum_{i=1}^{n_S} Restrcited\ stock_i \times t_i + \sum_{j=1}^{n_O} Option_j \times t_j}{Salary+Bonus + \sum_{i=1}^{n_S} Restrcited\ stock_i + \sum_{j=1}^{n_O} Option_j}, \qquad (1)$$

where *Salary* and *Bonus* are the dollar values of annual salary and bonus, *Restricted stock*$_i$ is the dollar value of the i^{th} equity compensation of restricted stocks with corresponding vesting period t_i (in months), and *Option*$_j$ is the fair value of the j^{th} equity compensation of stock options with

corresponding vesting period t_j (in months). During the year *t*, an executive may be awarded multiple equity grants with different vesting periods, and n_s and n_o are the total number of such grants in stock and options, respectively.

I obtain detailed compensation data to construct *Incentive duration* from Incentive Lab. Incentive Lab is a comprehensive compensation database that contains in-depth information from corporate reports and proxy statements about compensation of executive officers and directors (e.g., Bettis, Bizjak, Coles, and Kalpathy 2013). In particular, it provides grant-by-grant information of equity awards such as vesting schedules, vesting periods, and fair values, which is usually not available in standard compensation databases. The in-depth compensation data from Incentive Lab allow me to construct *Incentive duration* to measure incentive horizon.

Finally, I intersect the executive network data from BoardEx with the incentive horizon data from Incentive Lab and complement firm characteristics using data from COMPUSTAT and CRSP. The sample period is from 2000 through 2012. The boundary of the sample is set by BoardEx and Incentive Lab, which mostly covers S&P 1500 firms. The final sample contains executive level data of network connections and incentive horizon with 33,605 observations, which covers 9,204 executive officers from 943 firms during the time period of 2000 – 2012.

I am facing several data limitations when drawing inferences from the final sample. First, the social network of an individual is dynamically changing and difficult to fully capture. To the extent that the network data I use from BoardEx covers mainly S&P 1500 firms in the U.S., the network measures in this paper may underestimate the *actual* network connectedness for executives. Be that as it may, it is perhaps relevant to focus on network connectedness among executives and directors who has worked in a S&P 1500 firm, through which the information access and potential job opportunities may be more valuable to both firms and executives.

Second, in this version of the paper, I focus on the incentive duration of *new* equity awards granted to executives every year. While the new equity awards reflect the most current incentive horizon, grants that were awarded before but are yet to fully vest remain important to the overall incentive horizon. I plan to address this issue by including in the next version of the paper alternative measures of incentive horizon that take into account the current and past equity grants.

3.2 Summary Statistics

Our summary statistics, reported in Table 2, show that the average *Incentive duration* for an executive is 17.25 months, while the median is 16.56 months. An increase of 5.63 months moves the 25th percentile of *Incentive duration* to the median, and another increase of 5.58 months moves the median of *Incentive duration* to the 75th percentile. Taken together, the distribution statistics of *Incentive duration* seem to suggest that its distribution in the final sample is quite symmetric.

Figure 1 displays average incentives horizon for executives across the Fama-French 49 industries. The considerable amounts of variations across industries suggest that it is important to control for industry heterogeneity. Similar to Gopalan, Milbourn, Song, and Thakor (2013), I also find that executive incentive horizon is longer in industries that usually have long project horizon such as Aircraft, Medical Equipment, Shipbuilding, Pharmaceuticals and that have significant intangible assets such as Computers and Computer Software. Figure 2 represents the average incentive horizon for executives along the time period of 2000 – 2012. While *Incentive duration* is generally stable during 2000 – 2005 and 2006 – 2012, the seemly jump in 2006 warrants further investigation. One potential explanation may be that after the adoption of FAS

123R in 2005, large public firms in the U.S. are required to expense their stock options in the income statement using fair value on the grant date, which leads to more compensation expenses and thus results in the decline of option awards to executives.[3] Another consequence of the adoption of FAS 123R may be the increase of vesting periods, which may help reduce the compensation expenses in the income statement and may also accidentally increase *Incentive duration*. Therefore, it is important to control for the time series heterogeneity in incentive horizon.

Executive network connectedness is mainly measured by *Total connections*, which is total number of individuals with whom the executive shares a common employment or educational history in BoardEx, which excludes those individuals who are employed by the executive's current firm. On average, the typical executive in the final sample is connected via employment or educational network to 214 individuals who have worked in an S&P 1500 firm. 136 of the connections come from shared employment history, and the remaining 77 connections come from alumni network based on university education during overlapping years. Compared to the mean, the median value of *Total connections* is 131 and thus indicates that the distribution is skewed to the right. I therefore use the natural logarithm of network connectedness in regressions to reduce the influence of outliers. Similarly, the final sample mainly covers S&P 1500 firms and thus has distributions of assets and sales to be also skewed to the right, and I use the natural logarithm of these variables in regressions to reduce the influence of outliers.

Lastly, I include two instruments for network connections in the summary statistics. These instruments are used in instrumental variable regressions to address the endogeneity concern that network connectedness may also capture unobservables such as ability. The motivation and validity of these instruments are discussed in later sections. *Number of prior*

[3] For example, see Hayes, Lemmon, and Qiu (2012) for detailed discussion.

firms is the number of public firms the executive has worked for, and *Graduate degree indicator* measures whether the executive has earned a graduate degree. On average, an executive in our sample has worked for 2.67 firms, and 62% of the executives in the final sample have earned a graduate degree. I use the natural logarithm of *Number of prior firms* in regressions to reduce the influence of outliers. To reduce the influence of extreme values, I winsorize distributions of all variables at the 1st and 99th percentiles.

3.3 Econometric Specifications

Our empirical model to examine the effects of executive connections on incentive horizon is a linear specification,

$$y_{ijkt} = \alpha + \beta' network_{ijkt} + \gamma' x_{jkt} + \delta' \mu_k + \varphi' \nu_t + \varepsilon_{ijkt}, \quad (2)$$

where *i* indicate individuals, *j* indicates firms, *k* indicates industries, and *t* indicates years. The outcome variable, y_{ijkt}, represents the incentive horizon, *Incentive duration*, for an executive in a firm during a year. The covariate $network_{ijkt}$ is the natural logarithm of network connections, *ln(Total connections)*. The vector x_{jkt} controls for firm characteristics, μ_k represents two-digit SIC industry fixed effects, and ν_t represents year fixed effects. I assume that the executive-firm-year specific error term, ε_{ijkt}, is heteroskedastic and correlated within individuals and follow Petersen (2009) in reporting robust standard errors clustered by executives in all regressions.

Individuals with larger network size often tend to be those with high ability, and the better network connectedness of these individuals may merely capture their unobserved ability. Furthermore, firms may also use compensation contracts with longer incentive horizon to retain executives with high aptitude. To the extent that unobservables such as ability drives both network connections and incentive horizon, any findings from OLS regressions should be

interpreted with caution against causal inferences. To address such endogeneity concerns, I apply two-stage instrumental variable regressions in the following specification,

$$y_{ijkt} = \alpha + \beta\overline{network}_{ijkt} + \gamma' x_{jkt} + \delta' \mu_k + \varphi' \nu_t + \varepsilon_{ijkt}, \quad (3)$$

where $\overline{network}_{ijkt}$ is estimated from firs-stage instrumental variable regressions using control variables in Equation (2) and two excluded instruments: the natural logarithm of *Number of prior firms* and *Graduate degree indicator*. Similar instruments are also used in Faleye, Kovacs, and Venkateswaran (2013). The rationale to use these instruments is that on the one hand the past working experience and graduate school education may be mechanically associated with network size, on the other hand it is not clear how the number of prior firms to work for and the graduate degree could be indicative of an individual's ability that is relevant in business world. For example, a high-tech company may be more likely to hire a long-term corporate senior officer who spends most of her career in a large IT company than some job hoppers who frequently switch among companies. Moreover, one may also argue that executives who never find the need or time to earn a graduate degree may be individuals of high aptitude. In later sections, I further discuss the relevancy and exclusion conditions for these instruments.

4. Results

4.1 Univariate Analysis

Table 3 displays correlation coefficients between variables of the full sample. Consistent with the hypothesis, incentive horizon and executive network connections are positively correlated, no matter the connectedness are measured by total connections, connections via shared employment history, or connections via shared education history. Similar to prior studies (e.g., Gopalan, Milbourn, Song, and Thakor 2013), I also find that incentive horizon and measures of firm risk are negatively correlated, and firms with R&D expenditures have longer incentive horizon. More interestingly, prior work history and graduate education are indeed positively correlated with network connections, with correlation coefficients as high as 0.512. In line with intuition, prior work history is more correlated with employment connections than with educational connections, while graduate education seems opposite. It also suggests that prior work history and graduate education are much more relevant for network connections than for incentive horizon, which may alleviate the concern that these excluded instruments directly affect incentive horizon. Overall, univariate results from correlation matrix are consistent with my hypotheses and prior studies, which motivate further investigation in multivariate regression frameworks.

4.2 Executive Connections and Incentive Horizon

Table 4 reports multivariate results for incentive horizon in the full sample. Column (1) include *ln(Total connections),* industry fixed effect, and year fixed effect as independent variables. Column (2) further controls for firm characteristics such as firm size, debt and investment policies, and market valuation. Column (3) adds controls for firm performance and

firm risk. The coefficients on *ln(Total connections)* are positive for all three specifications and are statistically significant at the 1% level. Consistent with the hypothesis, better connected executives have longer incentive horizon. In terms of economic significance, a one standard deviation increase in *ln(Total connections)* is associated with a 4% increase of *Incentive duration* from its mean, which amounts to 8% of the standard deviation of *Incentive duration*.[4]

Most of the control variables in Table 4 have signs consistent with prior literature. Incentive horizon for executives is longer in R&D firms and firms that have larger sales, more growth opportunities, and less volatile stock performance. Interestingly, firms that currently underperform in terms of ROA and stock returns have longer executive incentive horizon. It is possible that underperforming firms may have managerial turnovers, and newly hired executives have to accept contracts with longer vesting periods due to lack of bargaining power. Given that turnover risk may affect incentive horizon, I will examine the effect of executive connections on incentive horizon with controls for turnover conditions in the next version of the paper.

Consistent with the univariate results, the multivariate results in Table 4 also find that executives with larger networks have longer incentive horizon. Control for common determinants suggested by prior studies, I show that network connections are significantly and positively associated with incentive horizon.

4.3 Executive Connections and Incentive Horizon: Subsample Analysis

In this section I examine whether previous results hold in subsample analysis. Figure 2 may indicate an exogenous shock to incentive horizon around 2006 possibly due to changes in accounting practices. I divide the full sample into before-2006 subsample and post-2006

[4] 1.114 × 0.627 ÷ 17.25 = 0.04, where 1.114 is the *sample standard deviation* of ln(Total connections, 0.627 is the *coefficient* on ln(Total connections) in Column (3), Table 4, and 17.25 is the *sample mean* of Incentive duration. 1.114 × 0.627 ÷ 9.04 = 0.08, where 9.04 is the *sample standard deviation* of Incentive duration.

subsample to investigate whether the effect of network connection on incentive horizon is concentrated in certain subsample. Column (1) and (2) of Table 5 show that the coefficients on *ln(Total connections)* are both positive and significant at the 1% level. It suggests that despite a potential shock from changes in accounting practices, the positive association between network connections and incentive horizon is significant before and after such shock. Prior studies find that firm size is an important determinant of incentive horizon for executives. I then divide the full sample into small firm subsample and large firm subsample to investigate whether the effect of network connection on incentive horizon is concentrated in certain size of firms. The small firm subsample refers to firms with total assets smaller than the sample median, while the large firm subsample refers to firms with total assets larger than the sample median. Column (3) and (4) of Table 5 show that the coefficients on *ln(Total connections)* are both positive and significant at the 1% level. It seems that the marginal effect of network connections on incentive horizon is more pronounced in large firm, which may imply that executives with larger networks are particularly valued by large firms. Overall, results of Table 5 continue to support the hypothesis that executive network connectedness is an effective and important determinant of incentive horizon.

4.4 Executive Connections and Incentive Horizon: Alternative Measures

Table 6 investigates incentive horizon using alternative measures of network connectedness. Instead of *ln(Total connections),* I use *ln(Employment connections)* and *ln(Educational connections)* to measure subcategories of network connectedness. Column (1) and (2) of Table 6 show that connections via employment history and education history are positively associated with the horizon of executive compensation, respectively. When put

together in Column (3), these two subcategories of network connectedness also jointly determine the horizon of executive incentives. Moreover, Column (3) of Table 6 finds that the coefficient on *ln(Employment connections)* is significantly larger than that on *ln(Educational connections)* at the 1% level. It seems to imply that the marginal effect of employment-induced connections on incentive horizon is more pronounced than that of education-induced connections. Certain companies and education institutions are famous for fostering networks and training future top managers and directors. Given the rich data I have on biographical information of executives and directors from BoardEx, it would be interesting to further investigate whether results of Table 6 hold for connectedness via these companies and education institutions. In sum, while I find that incentive horizon is more affected by network connections based on past employment than past education, both measures point to the same finding: better connected executives have longer horizon of incentives.

4.5 Executive Connections and Incentive Horizon: Instrumental Variable Regressions

So far I have shown a positive and significant association between an executive's network connectedness and her incentive horizon, and this association is robust in subsample analysis and with alternative measures of connections. Yet it is difficult to estimate the causal effect of network connectedness on incentive horizon as they may be jointly determined. First, unobservables such as individual ability are likely to affect both network connections and incentive horizon. Individuals of high ability may be central in social networks and thus have high connectedness, while firms may provide long term contracts in order to retain top talents. As a result, such unobservables are hidden in the error term in Equation (2), and they may cause biases in estimation as they are correlated with both incentive horizon and network connections.

Second, managerial compensation is the equilibrium outcome of a matching mechanism between executives and the board. It is possible that the board has private information about the growth potential of the firm, and it seeks to hire or retain executives that may help fulfil the firm's growth opportunities. For example, when a pharmaceutical firm is planning to start a new pipeline, the board may hire a well-connected executive officer and offer her long term contracts. The matching between network connectedness and horizon of executive incentives also challenge the estimation of causal effect.

To address the endogeneity concern that unobservables such as individual aptitude jointly determines network connections and incentive horizon, I use two-stage instrumental variable regressions in Table 7. Consistent with prior studies, I explore variations in the prior employment history and education background, and I use the number of firms an executive has worked for and whether she has graduate degree as excluded instruments. I argue that these instruments are correlated with network connections and are uncorrelated with the error term in Equation (2).

Column (1) through (3) consistently show that the coefficients on *ln(Total connections)* are positive and significant at the 5% level. Instead of using the raw value of *ln(Total connections)*, I estimate *ln(Total connections)* from the first-stage regression and use the predicted *ln(Total connections)* in the second-stage regressions. The first stage F statistics are significant at the 1% level. Kleibergen-Paap rk LM statistic from Underidentification test are significant at the 1% level. Kleibergen-Paap rk Wald F statistic from Weak instrument test are significant at the 1% level and well above the critical values (around 20) of Stock-Yogo test for weak instruments. Taken together, these results reject null hypotheses that the instruments are weak and the model is underidentified. In other words, I find strong evidence to support the relevancy condition for instruments. Moreover, the Hansen J statistics are not significant at all,

not rejecting the null hypothesis of overidentification. That is, the exclusion condition cannot be rejected. Therefore, these econometric tests suggested by prior literature show that the instruments used in Table 7 seem to satisfy both the relevancy condition and the exclusion condition, and hence they are valid instruments. The instrumental variable regressions in Table 7 confirm what I find in previous multivariate analysis: Network connectedness of an executive positively affects her horizon of compensation incentives.

4.6 Future Work

For now the findings in this paper remain preliminary, and I acknowledge several issues that remain to address in the next version of the paper. First, it is important to construct incentive horizon that also captures unvested equity grants that were awarded in previous years. In this version of the paper, I focus on the duration of *new* equity grants to executives. While the new equity awards reflect the most current incentive horizon, grants awarded in previous years but yet to fully vest remain important to the overall incentive horizon. I plan to address this issue by including in the next version of the paper alternative measures of incentive horizon that take into account the past equity grants. Second, in addition to the number of connections via networks, prior literature also uses other measures of connectedness such as betweenness, closeness, and eigenvalue. While existing papers generally find consistent results using either of these measures, it would be interesting to investigate whether certain measures of network centrality have more pronounced effect on horizon of managerial incentives. Third, although I develop the hypothesis by arguing information access and turnover risk are two effective channels for network connections to affect incentive horizon, I never formally test these channels in this version of the paper. I plan to investigate managerial turnover events to check whether better

connected executives do have less turnover risk in my sample. I also plan to identify conditions where information access is more critical to firms and examine whether under these conditions the effect of network on incentive horizon is stronger. Last, while using incentive horizon as the economic outcome variables does address an understudied and crucial area of executive compensation, it would be interesting to also examine other corporate outcome variables, especially variables that capture long-term growth in firms. It is intuitive to conjecture that if network connections increase the horizon of executive incentives, they may also affect long-term growth in firms via managerial incentive horizon. These tests may broaden the scope of this paper and substantiate its contribution to the literature.

5. Conclusion

Executive incentive horizon is of central importance in recent studies on managerial compensation because of its positive effect in fostering long-term behaviors in corporations. Few papers have looked into managerial attributes that may affect executive incentive horizon. In this paper, I study the relation between executive connections and the horizon of managerial incentives. I hypothesize that better connected executives have longer incentive horizon because larger networks alleviate their career concerns, imply more potential access to information spillover, and thus induce managerial incentives more toward long-term.

I construct measures of incentive horizon and executive connections in a sample of more than 9,000 executives in S&P 1500 firms from 2000 through 2012. I use the duration of managerial compensation to measure incentive horizon, and I use the total number of executive connections to measure the executive's network centrality. I find strong evidence that better connected executives have significantly longer horizon of compensation incentives. To mitigate

the endogeneity concern due to omitted variables, I explore variations in past employment and education history to construct instruments for executive connections. In instrumental variable regressions, I find that network connectedness of an executive significantly and positively affect her incentive horizon. Taken together, the empirical evidence strongly support that network connection is an important factor that induces long horizon of managerial incentives.

I contribute to the literature in three folds. First, I contribute to the literature on managerial incentive horizon. Recent paper by Gopalan, Milbourn, Song, and Thakor (2013) document important firm characteristics that determine incentive horizon, and I extend their study by focusing on managerial attributes, i.e. network connections, that play crucial roles in managerial career concerns and information spillovers. Second, I also contribute to the literature on social networks and executive compensation. Engelberg, Gao, and Parsons (2013) show that CEOs with larger networks have higher compensation, and I complement their paper by documenting that executive connections not only affect *how much* executives are paid but also change *how* they are paid. Third, I contribute to the literature on corporate long-term behaviors by providing a potential channel that links executive connections to long-term firm performance. Building on recent papers that show longer incentive horizon help firms alleviate managerial short-termism (e.g., Gopalan, Milbourn, Song, and Thakor 2013; Cadman and Sunder 2014; Cheng, Cho, and Kim 2014), my findings imply that executive connections may facilitate corporate long-term performance via the channel of incentive horizon.

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Figure 1

Incentive Horizon by Industry

Figure 1 displays the average incentives horizon for executives across the Fama-French 49 industries. I measure incentive horizon for an executive by *Incentive duration*, the weighted average duration of four components of compensation (salary, bonus, restricted stock, and stock options) as in Equation (1) of Gopalan, Milbourn, Song, and Thakor (2013):

$$\textit{Incentive duration} = \frac{(Salary+Bonus)\times 0 + \sum_{i=1}^{n_s} Restrcited\ stock_i \times t_i + \sum_{j=1}^{n_o} Option_j \times t_j}{Salary+Bonus + \sum_{i=1}^{n_s} Restrcited\ stock_i + \sum_{j=1}^{n_o} Option_j},$$

where *Salary* and *Bonus* are the dollar values of annual salary and bonus, *Restricted stock*$_i$ is the dollar value of the i^{th} equity compensation of restricted stocks with corresponding vesting period t_i (in months), and *Option*$_j$ is the fair value of the j^{th} equity compensation of stock options with corresponding vesting period t_j (in months). During the year *t*, an executive may be awarded multiple equity grants with different vesting periods, and n_s and n_o are the total number of such grants in stock and options, respectively.

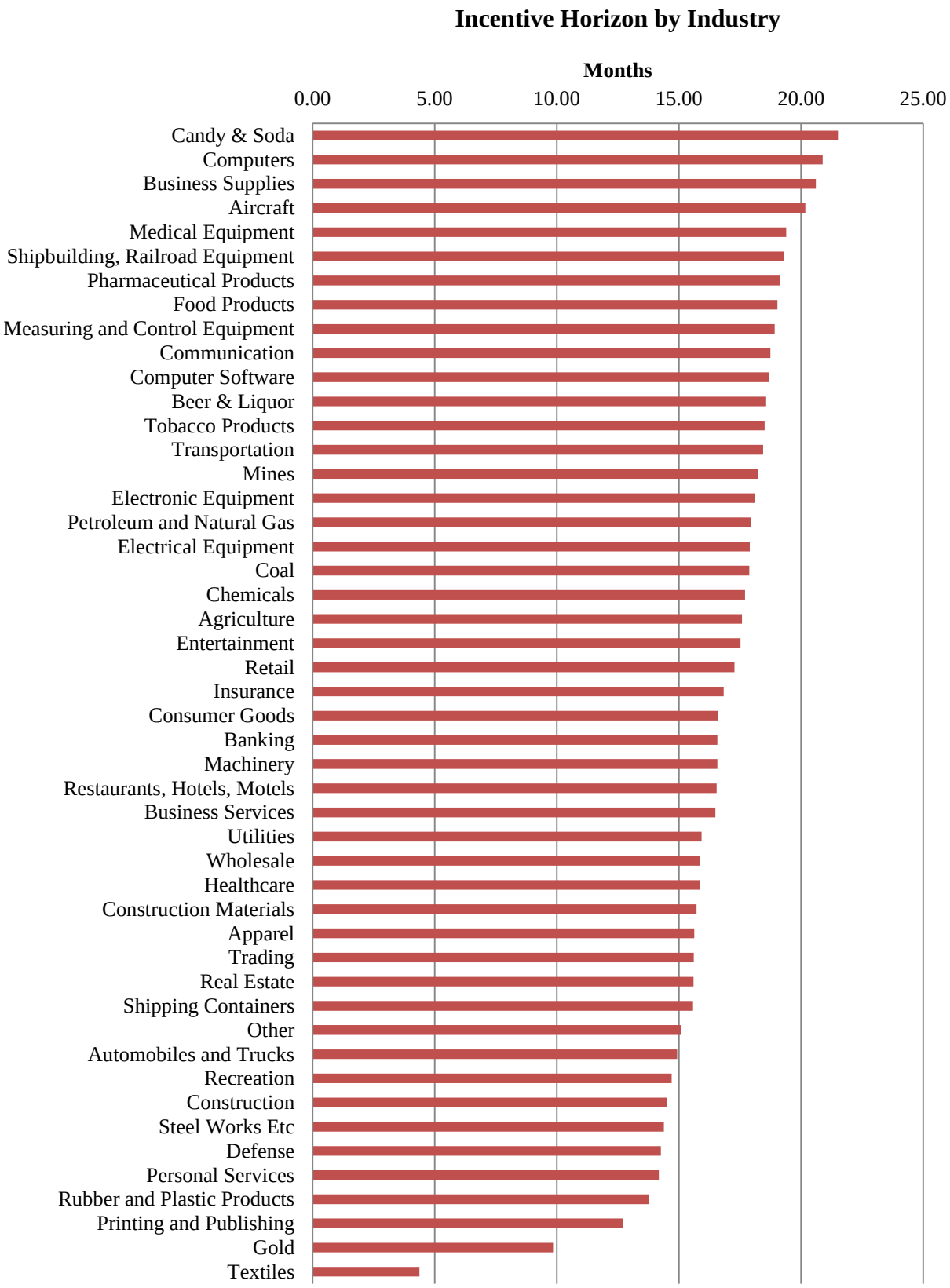
Incentive Horizon by Industry
Months
0.00
5.00
10.00
15.00
20.00
25.00
Candy & Soda
Computers
Business Supplies
Aircraft
Medical Equipment
Shipbuilding, Railroad Equipment
Pharmaceutical Products
Food Products
Measuring and Control Equipment
Communication
Computer Software
Beer & Liquor
Tobacco Products
Transportation
Mines
Electronic Equipment
Petroleum and Natural Gas
Electrical Equipment
Coal
Chemicals
Agriculture
Entertainment
Retail
Insurance
Consumer Goods
Banking
Machinery
Restaurants, Hotels, Motels
Business Services
Utilities
Wholesale
Healthcare
Construction Materials
Apparel
Trading
Real Estate
Shipping Containers
Other
Automobiles and Trucks
Recreation
Construction
Steel Works Etc
Defense
Personal Services
Rubber and Plastic Products
Printing and Publishing
Gold
Textiles

Figure 2

Incentive Horizon by Year

Figure 2 displays the annual average incentives horizon for executives from 2000 through 2012. I measure incentive horizon for an executive by *Incentive duration*, the weighted average duration of four components of compensation (salary, bonus, restricted stock, and stock options) as in Equation (1) of Gopalan, Milbourn, Song, and Thakor (2013):

$$Incentive\ duration = \frac{(Salary+Bonus)\times 0 + \sum_{i=1}^{n_s} Restrcited\ stock_i \times t_i + \sum_{j=1}^{n_o} Option_j \times t_j}{Salary+Bonus + \sum_{i=1}^{n_s} Restrcited\ stock_i + \sum_{j=1}^{n_o} Option_j},$$

where *Salary* and *Bonus* are the dollar values of annual salary and bonus, *Restricted stock*$_i$ is the dollar value of the i^{th} equity compensation of restricted stocks with corresponding vesting period t_i (in months), and *Option*$_j$ is the fair value of the j^{th} equity compensation of stock options with corresponding vesting period t_j (in months). During the year *t*, an executive may be awarded multiple equity grants with different vesting periods, and n_s and n_o are the total number of such grants in stock and options, respectively.

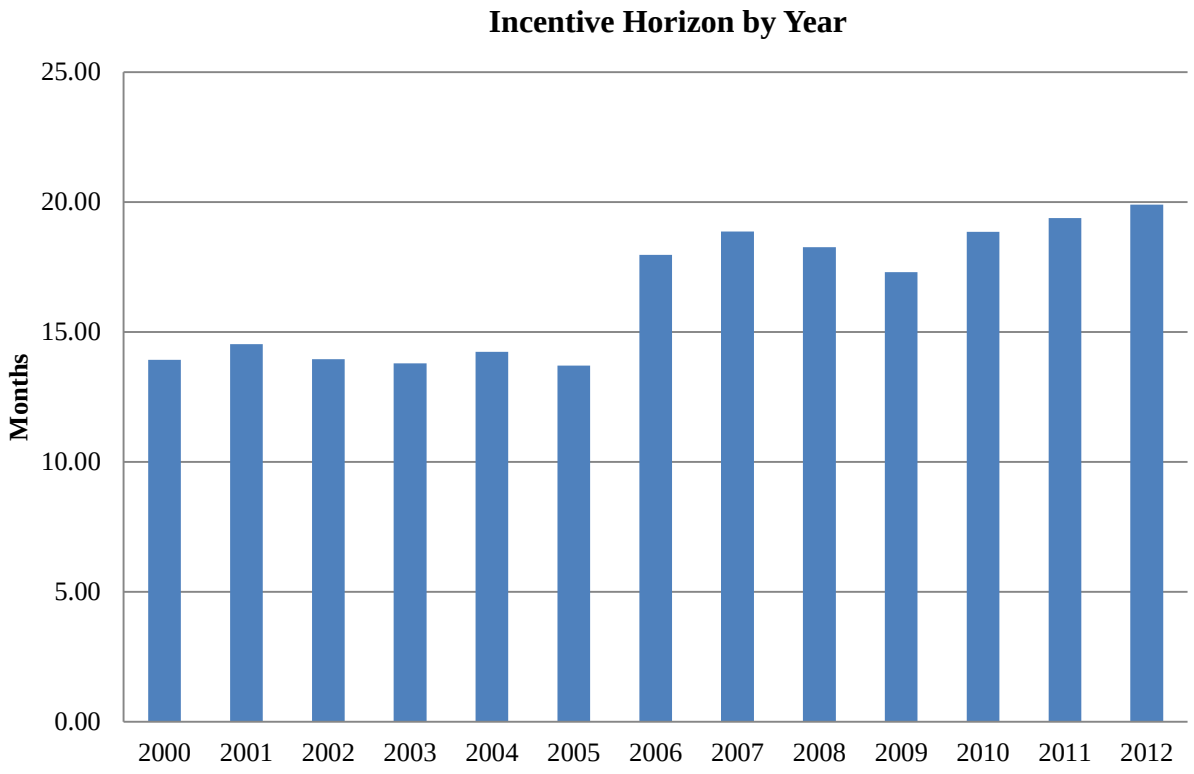

Table 1

Variable	Definition
Incentive horizon	
Incentive duration	The weighted average duration of four components of compensation (salary, bonus, restricted stock, and stock options) as in Equation (1) of Gopalan, Milbourn, Song, and Thakor (2013): *Incentive duration* = $\frac{(Salary+Bonus)\times 0 + \sum_{i=1}^{n_S} Restrcited\ stock_i \times t_i + \sum_{j=1}^{n_O} Option_j \times t_j}{Salary+Bonus + \sum_{i=1}^{n_S} Restrcited\ stock_i + \sum_{j=1}^{n_O} Option_j}$, where *Salary* and *Bonus* are the dollar values of annual salary and bonus, *Restricted stock*$_i$ is the dollar value of the i^{th} equity compensation of restricted stocks with corresponding vesting period t_i (in months), and *Option*$_j$ is the fair value of the j^{th} equity compensation of stock options with corresponding vesting period t_j (in months). During the year *t*, an executive may be awarded multiple equity grants with different vesting periods, and n_s and n_o are the total number of such grants in stock and options, respectively.
Executive network	
Total connections	The total number of individuals with whom the executive shares a common employment or educational history in BoardEx, which excludes those individuals who are employed by the executive's current firm.
Employment connections	The number of individuals with whom the executive shares a common employment history in BoardEx, which excludes those individuals who are employed by the executive's current firm.
Educational connections	The number of individuals with whom the executive shares a common educational history in BoardEx, which excludes those individuals who are employed by the executive's current firm.

Table 1 (Continued)

Variable	Definition
Firm characteristics	
Assets	Firm's total assets.
Cash flow risk	Standard deviation of annual ROA in prior five years.
Debt ratio	Total debts / Assets.
Long-term assets ratio	PP&E / Assets.
Market-to-book ratio	Market value of assets / Book value of assets.
R&D indicator	Equal to one if R&D expenditure is positive and zero otherwise.
ROA	Net income / Assets.
Sales	Firm's sales.
Stock return	Average of monthly stock returns in excess of market returns.
Volatility	Standard deviation of monthly excess stock returns in a year.
Instruments for network connections	
Number of prior firms	The number of public firms the executive has worked for.
Graduate degree indicator	Equal to one if the executive has earned a graduate degree and zero otherwise.

Table 2

Summary Statistics

Table 2 reports the summary statistics of the full sample. I use BoardEx data from 2000 through 2012 intersected with COMPUSTAT, CRSP, and Incentive Lab. Variable definitions are described in Table 1. All variables are on firm/year/executive level.

VARIABLES	N	Mean	S.D.	25th %	Median	75th %
Incentive horizon						
Incentive duration	33,605	17.25	9.04	10.93	16.56	22.14
Executive network						
Total connections	33,605	214.28	239.77	53	131	281
Employment connections	33,605	135.80	190.93	30	63	148
Educational connections	33,605	76.86	107.19	0	27	117
Firm characteristics						
Assets ($ millions)	33,605	25,102	74,779	2,260	5,637	17,116
Cash flow risk	33,605	0.03	0.03	0.01	0.02	0.04
Debt ratio	33,605	0.25	0.18	0.12	0.23	0.35
Long-term assets ratio	33,605	0.27	0.24	0.08	0.19	0.41
Market-to-book ratio	33,605	1.84	1.00	1.15	1.50	2.13
R&D indicator	33,605	0.44	0.50	0	0	1
ROA	33,605	0.05	0.08	0.02	0.05	0.09
Sales	33,605	10,482	18,685	1,652	3,998	10,155
Stock return (%)	33,605	0.65	2.70	-0.88	0.45	2.07
Volatility	33,605	0.09	0.05	0.05	0.07	0.10
Instruments for network connections						
Number of prior firms	29,556	2.67	0.97	2	2	3
Graduate degree indicator	29,556	0.62	0.48	0	1	1

Table 3

Correlation Matrix

Table 3 displays correlation coefficients between variables of the full sample. Variable definitions are described in Table 1. All variables are on firm/year/executive level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	1	2	3	4
1. Incentive duration	-			
2. ln(Total connections)	0.156***	-		
3. ln(Employment connections)	0.173***	0.804***	-	
4. ln(Educational connections)	0.081***	0.701***	0.257***	-
5. ln(Assets)	0.168***	0.278***	0.317***	0.154***
6. Cash flow risk	-0.018***	-0.041***	-0.061***	-0.021***
7. Debt ratio	-0.036***	0.011**	-0.001	0.024***
8. Long-term assets ratio	-0.015***	-0.088***	-0.138***	0.016***
9. Market-to-book ratio	0.102***	0.029***	0.029***	0.012**
10. R&D indicator	0.084***	0.177***	0.222***	0.046***
11. ROA	0.076***	-0.008	0.005	-0.020***
12. ln(Sales)	0.177***	0.283***	0.349***	0.121***
13. Stock return	-0.063***	-0.056***	-0.073***	-0.012**
14. Volatility	-0.098***	-0.054***	-0.062***	-0.040***
15. ln(Number of prior firms)	0.042***	0.402***	0.512***	0.120***
16. Graduate degree indicator	0.024***	0.206***	0.113***	0.194***

Table 4

The Effect of Executive Connections on Incentive Horizon

Table 4 examines the effect of executive connections on incentive horizon in the full sample. The sample period is from 2000 through 2012. Dependent variables are *Incentive duration*. Variable definitions are described in Table 1. Industry and year fixed effects are included, and robust standard errors adjusted for clustering by executive are presented in the parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
ln(Total connections)	1.083***	0.632***	0.627***
	(0.0707)	(0.0717)	(0.0718)
ln(Sales)		1.245***	1.245***
		(0.0643)	(0.0686)
Long-term assets ratio		0.687	0.814
		(0.609)	(0.617)
R&D indicator		0.644**	0.639**
		(0.278)	(0.283)
Debt ratio		-0.742	-0.683
		(0.516)	(0.537)
Market-to-book ratio		1.251***	1.404***
		(0.0789)	(0.0874)
ROA			-2.485***
			(0.865)
Stock return			-12.14***
			(1.886)
Volatility			-3.548**
			(1.515)
Cash flow risk			0.962
			(2.399)
Constant	14.67***	-13.56***	-13.50***
	(0.377)	(1.438)	(1.540)
Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	33,605	33,605	33,605
Adjusted R^2	0.118	0.152	0.154

Table 5

The Effect of Executive Connections on Incentive Horizon: Subsample Analysis

Table 5 examines the effect of executive connections on incentive horizon in subsamples. The sample period is from 2000 through 2012. Dependent variables are *Incentive duration*. Column 1 and 2 report regression results in subsamples with time period from 2000 through 2005 and from 2006 through 2012, respectively. Column 3 and 4 report regression results in subsamples with asset size below the sample median and above the sample median, respectively. Variable definitions are described in Table 1. Industry and year fixed effects are included, and robust standard errors adjusted for clustering by executive are presented in the parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1) 2000 - 2005	(2) 2006 - 2012	(3) Small firms	(4) Large firms
ln(Total connections)	0.595***	0.657***	0.421***	0.848***
	(0.129)	(0.0803)	(0.0913)	(0.111)
ln(Sales)	0.931***	1.363***	1.004***	0.895***
	(0.128)	(0.0721)	(0.117)	(0.125)
Long-term assets ratio	-0.0302	0.760	0.948	-0.183
	(1.165)	(0.624)	(0.771)	(1.012)
R&D indicator	1.107**	0.439	0.586*	0.666
	(0.528)	(0.308)	(0.345)	(0.470)
Debt ratio	-0.654	-0.515	-1.057*	0.185
	(1.118)	(0.514)	(0.562)	(1.050)
Market-to-book ratio	1.186***	1.441***	1.367***	1.500***
	(0.156)	(0.104)	(0.103)	(0.162)
ROA	0.752	-3.359***	-2.384**	-0.937
	(1.897)	(0.976)	(1.028)	(1.682)
Stock return	-22.99***	-8.115***	-12.66***	-12.23***
	(3.941)	(2.023)	(2.488)	(2.842)
Volatility	10.04***	-8.159***	-0.991	-7.097***
	(2.967)	(1.705)	(2.090)	(2.183)
Cash flow risk	-10.60**	5.648**	0.0112	3.133
	(4.440)	(2.855)	(3.036)	(3.986)
Constant	-12.63***	-16.08***	-7.573***	-6.367**
	(2.802)	(1.632)	(2.598)	(2.786)
Industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	10,447	23,158	16,839	16,766
Adjusted R^2	0.106	0.123	0.142	0.163

Table 6

The Effect of Executive Connections on Incentive Horizon: Alternative Measures

Table 6 examines the effect of executive connections on incentive horizon using alternative measures of connections. The sample period is from 2000 through 2012. Dependent variables are *Incentive duration*. Variable definitions are described in Table 1. Industry and year fixed effects are included, and robust standard errors adjusted for clustering by executive are presented in the parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
ln(Employment connections)	0.582***		0.472***
	(0.0752)		(0.0765)
ln(Educational connections)		0.258***	0.212***
		(0.0336)	(0.0341)
ln(Sales)	1.231***	1.373***	1.208***
	(0.0697)	(0.0672)	(0.0696)
Long-term assets ratio	0.834	0.684	0.826
	(0.617)	(0.618)	(0.618)
R&D indicator	0.630**	0.788***	0.607**
	(0.284)	(0.281)	(0.283)
Debt ratio	-0.713	-0.622	-0.688
	(0.540)	(0.537)	(0.537)
Market-to-book ratio	1.413***	1.412***	1.393***
	(0.0871)	(0.0875)	(0.0873)
ROA	-2.572***	-2.728***	-2.370***
	(0.864)	(0.865)	(0.863)
Stock return	-12.10***	-12.47***	-12.09***
	(1.887)	(1.884)	(1.885)
Volatility	-3.588**	-3.072**	-3.513**
	(1.519)	(1.512)	(1.512)
Cash flow risk	1.112	1.129	1.111
	(2.397)	(2.404)	(2.397)
Constant	-12.74***	-14.07***	-12.23***
	(1.545)	(1.551)	(1.544)
Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	33,605	33,605	33,605
Adjusted R^2	0.153	0.153	0.156

Table 7

Executive Connections on Incentive Horizon: Instrumental Variable Regressions

Table 7 examines the effect of executive connections on incentive horizon using instrumental variable regressions. The sample period is from 2000 through 2012. Dependent variables are *Incentive duration*. Column (1) through (3) report second-stage results of instrumental variable regressions, where *ln(Total connections)* is estimated by the number of public firms the executive has worked for, whether the executive has earned a graduate degree, and second-stage controls. See Appendix Table A1 for corresponding first-stage results of instrumental variable regressions. Variable definitions are described in Table 1. Industry and year fixed effects are included, and robust standard errors adjusted for clustering by executive are presented in the parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
ln(Total connections)	0.437**	0.357**	0.370**
	(0.185)	(0.180)	(0.180)
ln(Sales)		1.314***	1.320***
		(0.0759)	(0.0810)
Long-term assets ratio		0.832	0.919
		(0.644)	(0.654)
R&D indicator		0.888***	0.883***
		(0.301)	(0.305)
Debt ratio		-0.910	-0.858
		(0.557)	(0.579)
Market-to-book ratio		1.338***	1.477***
		(0.0816)	(0.0899)
ROA			-2.556***
			(0.912)
Stock return			-12.23***
			(1.994)
Volatility			-3.684**
			(1.597)
Cash flow risk			1.854
			(2.527)
Constant	-0.585***	-0.317**	-0.332**
	(0.165)	(0.161)	(0.162)
First stage F statistic	103.34***	131.47***	110.02***
Underidentification test	914.63***	974.02***	967.94***
Weak instrument test	718.48***	764.91***	755.83***
Hansen J statistic	0.82	0.34	0.35
Endogeneity test	15.75***	2.76*	2.30

Table 7 (Continued)

Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	29,556	29,556	29,556
Adjusted R^2	0.065	0.109	0.112

Appendix

Table A1

Executive Connections on Incentive Horizon: First-stage of IV Regressions

Table A1 reports first-stage results of instrumental variable regressions that examine the effect of executive connections on incentive horizon. The sample period is from 2000 through 2012. Dependent variables are *ln(Total connections)*. The excluded instruments are the number of public firms the executive has worked for and whether the executive has earned a graduate degree. See Table 7 for corresponding second-stage results of instrumental variable regressions. Variable definitions are described in Table 1. Industry and year fixed effects are included, and robust standard errors adjusted for clustering by executive are presented in the parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
ln(Number of prior firms)	1.220***	1.204***	1.201***
	(0.0360)	(0.0343)	(0.0344)
Graduate degree indicator	0.363***	0.338***	0.337***
	(0.0252)	(0.0237)	(0.0237)
ln(Sales)		0.267***	0.278***
		(0.00926)	(0.00969)
Long-term assets ratio		-0.0888	-0.0932
		(0.0877)	(0.0890)
R&D indicator		0.265***	0.254***
		(0.0403)	(0.0407)
Debt ratio		0.147**	0.104
		(0.0669)	(0.0690)
Market-to-book ratio		0.0391***	0.0603***
		(0.0116)	(0.0128)
ROA			-0.575***
			(0.122)
Stock return			-0.560***
			(0.205)
Volatility			0.0670
			(0.185)
Cash flow risk			0.428
			(0.341)
Constant	3.601***	-2.586***	-2.841***
	(0.0439)	(0.217)	(0.229)
First stage F statistic	103.34***	131.47***	110.02***

Table A1 (Continued)

Industry fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Observations	29,556	29,556	29,556
Adjusted R^2	0.226	0.320	0.323