Two Essays on Corporate Governance

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ABSTRACT

The first essay shows that academic directors significantly increase firms' innovation. Following an academic director's death and relative to a non-academic director's death, the average firm reduces the number of citation-weighted patent applications by 30.7%. The number of patent applications also increases when an academic director becomes less busy after another company she holds directorship is acquired. Consistent with an advising channel, academic directors in STEM disciplines are particularly pro-innovation. In line with monitoring channels, firms with academic directors tend to dismiss CEOs who do not innovate and restrict real earnings management that waste financial resources. The relation between academic directors and innovation is not driven by PhD CEOs or non-academic PhD directors. Academic directors are associated with higher firm value at firms where innovation is more important but not at other firms. Overall, our results highlight the vital advising and monitoring roles academic directors play in corporate innovation.

The second essay finds that pre-existing professional ties with a firm's board significantly increase a CEO candidate's probability of being hired by the firm. Considering all CEOs hired this year as potential candidates, a board-connection corresponds to a 152% increase in the probability the candidate is selected as CEO. Consistent with the hypothesis that boards select connected candidates to increase shareholder value, we find significantly greater firm performance improvement after CEO turnovers for firms hiring connected CEOs than those hiring unconnected CEOs. Further, the performance increases are significant only among firms with severe information asymmetry, large CEO termination risk, and high coordina-

tion costs. We also find that connected CEOs make better acquisitions than unconnected CEOs. These results suggest connected hiring increases firm performance because it reduces information asymmetry, CEO termination risk, and CEO-board coordination costs. Inconsistent with boards rendering favors to friends, connected CEOs are not awarded a larger pay package when they assume office. Overall, our results suggest that it pays for a firm to hire a CEO with pre-existing ties to the board.

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GENERAL AUDIENCE ABSTRACT

We see professors seating on corporate boards all the time. Why do firms hire them? Do they make firms innovate more because they have strong research orientation? The first essay finds that these directors enhance corporate innovation. They improve innovation with their STEM expertise. Because STEM disciplines are particularly relevant to production technology, they are able to advise the CEO about innovation. We also find that these directors make firms innovate more by linking CEO termination decisions to innovation and by preventing companies from wasting resources that could otherwise be used for innovation. Lastly, these directors improve firm value at firms where innovation is important.

The board makes CEO recruiting decisions. We are interested in knowing (1) whether candidates are more likely to be hired if they already had a connection with the board; (2) whether these candidates outperform candidates without any connections. The second essay finds that having an acquaintance on the board helps a CEO candidate land the CEO position. We also find that these CEOs outperform CEOs without any connections. This is because there is little information gap between the connected CEO and the board. Also, the pre-existing connections allow the two parties to have better coordination.

Contents

List of Tables

Chapter 1

Academic Directors and Corporate Innovation

1.1 Introduction

Independent directors on corporate boards are known to play vital advising and monitoring roles in firms. However, less is known about what skills independent directors possess are important for them to perform such roles. Prior studies examine independent directors' industry experience, financial expertise, or legal backgrounds (e.g., Dass et al. [31], Güner et al. [55], Krishnan et al. [79]). In this paper, we study *academic* directors who we define as independent directors with doctoral degrees whose primary career is in academia. Our interest in academic directors stems from the research orientation of the academic profession and its potential impacts on corporate innovation.

An academic director is inherently research-oriented. To earn a doctorate, a degree candidate needs to complete and successfully defend a dissertation. After that, if the person pursues an academic career in a research university, he will continue to conduct research and produce novel research output worthy of publication. Thus, an academic director has an intrinsic interest in research and development activities and will encourage and support the CEO to engage in innovative endeavors. Due to the long-term nature of research and development, intrinsic interest is especially effective for motivating innovation (Ryan and Deci [100], He and

Hirshleifer [61]). An academic director can also advise the CEO about specific R&D projects, especially if his research area overlaps with the scope of the projects. The introduction of an academic director by Eli Lilly fits this description. In its 2011 proxy statement, Eli Lily states that Alfred Gilman, Ph.D., "*is a Nobel Prize-winning pharmacologist, researcher, and professor. He has deep expertise in basic science, including mechanisms of drug action, and experience with pharmaceutical discovery research. As the former dean of a major medical school, he brings to the board important perspectives of both the academic and practicing medical communities.*"[1] In this paper, we empirically test the hypothesis that academic directors enhance corporate innovation.

Academic directors on boards is a common phenomenon. In a sample of 2,120 public firms from 2000 to 2017, we find that 31% firm-years have at least one academic director on the board. These academic boards are also widely distributed across industries.[2] Firms hiring academic directors are larger, older, less leveraged, and more R&D-intensive. Controlling for these potential determinants of academic boards and other firm and CEO characteristics, we find that firms with academic boards consistently engage in significantly more R&D activities. On average, total asset-scaled R&D expenditures are 0.9 to 1 percentage point higher at firms with academic boards than firms with non-academic boards. Firms with academic boards also produce more patents and patents with more citations. They generate 20.2% more patents and these patents attract 23.5% more citations than firms with non-academic boards. These results are consistent with our hypothesis that academic directors promote innovative activities by firms.

Naturally, a correlation between academic boards and innovations does not necessarily mean that the existence of academic directors *causes* firms to innovate more. Reverse causation is

[1] https://www.sec.gov/Archives/edgar/data/0000059478/000119312512095544/d281086ddef14a.htm

[2] One might question whether one academic director can necessarily make a difference on the board. We asked this question to a long-term director and learned that one director can make a difference by voicing a dissenting opinion or proposing a new topic, which opens a board discussion.

a concern. More innovative firms may want to elect academic directors for window-dressing without such directors actually having an effect on firm policies. Omitted variables could also be at work. For instance, He and Hirshleifer [61] document that CEOs with doctoral degrees innovate more. If firms with PhD CEOs tend to hire academic directors, PhD CEOs could be an omitted factor. We use three strategies to mitigate the endogeneity concerns. First, we explicitly include PhD CEO as a control. While we confirm the result in He and Hirshleifer [61] for PhD CEOs, we find that academic boards are positively and significantly correlated with the various innovation measures after controlling for PhD CEOs.[3] Second and more importantly, we examine exogenous declines in the fraction of academic directors on the boards resulting from academic director deaths. Compared with departure due to other reasons, death-related director departures are more likely to be exogenous. We find that, relative to control firms in the same industry and year with non-academic director deaths, firms experiencing academic director deaths (and declines in the fraction of academic directors) reduce their citation-weighted patent counts by 30.7% and total citations by 77.7%. These results corroborate our results from the panel data regressions and lend further support for our hypothesis. Third, we consider a shock that reduces an academic director's busyness resulting from the director's other directorship being eliminated by a merger. We find significant increases in patent applications and particularly the application of highly-cited patents after the shock. These results further confirm our hypothesis that academic directors promote innovation.

In our analysis, a director is defined as *academic* if he satisfies both conditions: (1) a doctoral degree, and (2) a primary career in academia. Some candidates, after earning doctoral degrees, do not join a research university and pursue an academic career, but instead go to

[3] We also check whether the coexistence of academic directors and PhD CEOs could strengthen firms' innovative efforts. We test this possibility by adding an interaction term between academic board and PhD CEO. We do not find any evidence of an interaction effect.

work in an industry position. We refer to directors with doctorates but who do not work in academia as *industry PhD* directors. Because an academic job focuses on research activities while an industry job does not, the effects on innovations are likely to be more pronounced for academic directors than for industry PhD directors. To test this prediction, we define a board as an *industry PhD* board if there is at least one industry PhD director (but no academic director) on the board. We do not find a significantly positive association between industry PhD boards and innovations, suggesting that the effect of academic directors on innovation hinges on the academic career of the directors, not their doctoral degrees. We also compare director characteristics across director types and find that industry PhD directors have similar prior work experiences as non-PhD directors while academic directors are less experienced than both. This result corroborates our differentiation between academic directors and industry PhD directors and highlights the importance of the directors' academic careers.

We next investigate the channels through which academic directors influence innovation. In particular, we study an advising channel and a monitoring channel because these are the main functions of corporate boards. On the advising channel, we examine academic directors' disciplines because their disciplinary expertise enables them to advise the CEO about innovation. We posit that academic directors in STEM disciplines should be especially strongly associated with innovation because STEM expertise is particularly useful for innovation. We classify academic directors' disciplines into three categories: (1) science, technology, engineering, and math (STEM), (2) business, economics, and law (BUS), and (3) other (OTH). 62% of the 1,032 academic directors in our sample have a STEM background. Consistent with the advising channel, we find that academic directors with a STEM background are significantly associated with greater innovation expenses and output while directors with BUS and OTH backgrounds are not.

For the monitoring channels, we first check whether forced CEO turnovers are tied to innovation when academic directors are present. Due to the risky and long-term nature of innovation investment, CEOs are often reluctant to engage in innovative projects (e.g., Coles et al. [23], Gopalan et al. [52]). If academic directors use forced turnover as a disciplinary tool to motivate the CEO to innovate, we should find a more negative correlation between innovation and forced CEO turnover at firms with academic directors than at firms without academic directors. This is exactly what we find. By contrast, we should not and do not find a similar result for voluntary CEO turnovers. These results are in line with a monitoring channel at work. We also consider a second monitoring channel, the curbing of real earnings management. Real earnings management boosts earnings by reducing discretionary expenses, manipulating sales at the cost of cash flow from operations (CFO), and overproducing to lower average production costs (Roychowdhury [99]). Therefore, we check whether academic directors are associated with greater abnormal R&D expenses, higher abnormal CFO, and lower abnormal production, i.e., less real earnings management. Such results would be consistent with the notion that academic directors prevent managers from wasting company resources that could otherwise be used for innovation.

In the last part of our empirical analysis, we investigate firm value implications of academic directors. Greater corporate innovation facilitated by academic directors can lead to higher firm value. However, while academic directors are research-oriented and promote innovation, they also have limitations. In particular, academic directors generally lack industry experience, their areas of expertise may not match the firms' operations, and their evidence-driven approach may slow down decision making. Overall, the value effect of academic directors is unclear for the average firm. However, we hypothesize that academic directors are particularly valuable for innovative firms. Consistent with this prediction, we find that academic boards are associated with 5.0% higher firm value (measured by Tobin's Q) for high R&D

firms. By comparison, academic directors are not significantly related to firm value for low R&D firms. We also identify innovative firms using patent counts and the results are robust.

Because firms hiring academic directors are not only more R&D-intensive, but also larger, older, and less leveraged than firms not hiring academic directors, we also consider whether the association between academic directors and firm value differs along these other dimensions. To do so, we construct an indicator variable for mature firms (i.e. larger, older, and more leveraged firms) and check whether the link between academic directors and firm value varies with firm maturity. We do not find a significant association between academic directors and firm value for mature firms. All these results are robust to explicitly controlling for firms' R&D expenditures. Hence, while innovative firms and mature firms both tend to use academic directors, only innovative firms benefit from this policy. It is possible that mature firms hire academic directors for reasons not necessarily related to shareholder value. Lastly, we find that the academic director-firm value link at innovative firms is concentrated in cases where the academic directors have a STEM background.

Our findings contribute to two broad strands of the literature. First, we contribute to the literature on board member characteristics and firm outcomes. For example, Dass et al. [31], Drobetz et al. [34], and Faleye et al. [42] find that independent directors help enhance firm value with their industry experiences. Güner et al. [55] document that board members with financial expertise significantly influence firm financing and investment decisions. Adams and Ferreira [4] and Kim and Starks [75] show that female directors are associated with more effective advising and more intense monitoring. Krishnan et al. [79] show that the presence of directors with legal backgrounds on the audit committee is associated with higher financial reporting quality.[4] This paper complements previous studies by examining a very important

[4]Other related research documents the relevance of directors' international experience, CEO status and performance at another firm, and same industry experience to board monitoring and advising (e.g., Fich [45], Fahlenbrach et al. [41], Kang et al. [71], Masulis et al. [85]).

and previously understudied type of directors, *academic* directors. Our results on innovation and firm value corroborate critical advising and monitoring roles of academic directors.

We also contribute to the body of studies about the impact of corporate governance on innovation. Innovation investment is risky and takes a long time for potential gains to realize (e.g., Manso [84]). Because executives are risk-averse and tend to focus on short-term performance goals, they are often reluctant to invest in R&D (e.g., Coles et al. [23], Gopalan et al. [52]). Therefore, it is an important task for boards to encourage the CEOs to engage in innovative activities through contractual design and monitoring. There is substantial evidence that boards offer top executives option-based compensation and equity awards with long vesting periods to mitigate executives' aversion to innovation (e.g., Bebchuk and Fried [10], Coles et al. [23], Gopalan et al. [52], Manso [84]). It is also suggested that anti-takeover protection can make executives more willing to invest in R&D by shielding them from takeover threats before positive innovation outcomes manifest (Stein [103], Atanassov [8]). In this paper, we propose and find evidence that academic directors, who have an intrinsic interest in R&D, make executives innovate more through active monitoring.

Our paper is related to Adams et al. [3] who argue that director skills are multi-dimensional and identify 20 important director skill categories including "Academic". While Adams et al. [3] provide summary statistics about academic directors, they do not conduct in-depth analysis on this specific category of director skill. By contrast, we focus on academic directors and analyze their determinants and impacts in detail. Also related to our paper is He and Hirshleifer [61] who document a positive effect of PhD CEOs on innovation. We find that, after controlling for PhD CEOs, academic directors remain significantly associated with more innovation. Interestingly, our definition of "academic" is stricter than in Adams et al. [3] and He and Hirshleifer [61] by requiring both a doctorate and an academic career. This strict definition seems to be important for identifying academic directors because, as we show, directors with doctorates but not academic careers do not matter for innovation.

Our paper is also related to Francis et al. [47] who investigate how board members affiliated with universities affect firm performance. While Francis et al. [47] focus on the value effect of academic directors and only briefly touch upon innovation, we focus on and provide causal evidence on academic directors' impact on firms' innovation activities including R&D investment, patent quantity, quality and value. Additionally, Francis et al. [47] conclude that the average firm benefits from hiring professors as directors while we contend and find that academic directors are associated with higher firm value *only* at innovative firms. Lastly, part of Francis et al. [47]'s results do not survive in our sample. This could be due to the noisy definition of academic directors. They identify academic directors by searching keywords (e.g., university, college, institute, school, academy) without requiring doctoral degrees. In contrast, we ensure that an academic director has a doctoral degree *and* a primary career in academia. This helps us exclude clinical professors and professors of practice who are not research-oriented.

1.2 Data and Sample

1.2.1 Sample

Our sample begins with all firms that were in the S&P 1500 index at any time between 2000 and 2017.[5] We obtain board information and director characteristics from BoardEx. BoardEx records information about directors' characteristics such as age, tenure, independent status, retirement status, and the number of boards each director serves. Information about directors' education backgrounds (e.g., name of the school, type of degree, degree

[5] Our sample begins in 2000 because the BoardEx director characteristics file that we use to identify directorships begins in 2000.

award date) and employment histories (e.g., company name, position, starting date, ending date) are also from BoardEx.

We collect CEO characteristics such as age, tenure, and stock ownership from ExecuComp.[6] We extract financial information from Compustat North America Annual files, stock return data from CRSP files, institutional holdings data from the Thomson Reuters 13F database, and information about analyst coverage from I/B/E/S detail files. Patent issued, number of citations, and patent value are from Prof. Noah Stoffman's website (Kogan et al. [76]). We remove financial (SIC between 6000-6999) and utility (SIC between 4900-4949) firms and firms without a CRSP security code of 10 or 11. The final sample is an intersection of the ExecuComp, BoardEx, Compustat, and CRSP, and consists of 221,475 directorships in 24,599 firm-years on 2,120 different firms.

1.2.2 Academic Director

We classify academic directors as independent directors who satisfies both conditions: (1) a doctoral degree, and (2) a career in academia.[7] To identify the board members with research oriented doctoral degrees, we use the director education file in BoardEx and search the following keywords in the qualifications of directors: "PhD", "Doctor", "Doctorate", "Doctoral", "Postdoctoral", "DPhil", "Dr", "MD", "DM", "PharmD", "DDS", "DSc", "DVM", "ScD", "DMD", "DEng", "DPM", "VMD", "DMSc", "DHA", and "DDM".[8] To recognize the directors whose primary career is in academia, we use the director employment file

[6] We merge ExecuComp and BoardEx using BoardEx-CRSP Compustat Link provided by Wharton Research Data Services (WRDS).

[7] Our definition of academic director includes all directors with present or past academic experience. Thus, PhDs who worked in academia for many years and moved to industry are classified as academic directors. Nevertheless, the number of such directors is small in our sample. We acknowledge this potential measurement error.

[8] He and Hirshleifer [61] identify CEOs with PhD degrees by searching for a very similar set of keywords in the qualifications.

and search both the word "Professor" in the role name and the following keywords in the company name: "University", "School of", "Business School", "Medical School", "Institute of", "College". We exclude "Acting Professor", "Adjunct Professor", "Guest Professor", and "Honorary Professor" because these are considered either temporary positions or honorary titles granted for the contributions made to school or community.

To aggregate classifications from the director level to the firm level, we create a dummy variable equals to one if a firm has at least one academic director in a given year, and zero otherwise. We also calculate the fraction of independent directors who are academic directors as an alternative measure in our analyses.

1.2.3 Descriptive Statistics

Table 1 summarizes the characteristics of the boards, directors, firms, and CEOs in our sample. Panel A reports the characteristics of the boards. The mean of the Academic board is 0.31, indicating that a non-trivial portion (31%) of S&P 1500 companies have at least one academic director serving on their board. The mean fraction of independent directors who are academic directors is 6%, which implies that the fraction of a board's academic directors is small. The average firm in our sample has 9 directors on the board, 76% of which are independent directors. 51% of CEOs serve as chairman of the board. Panel B reports the characteristics of the directors in our sample. Out of 221,475 director-firm-year observations, 5% are academic directors. This number coincides with the related statistics documented in Adams et al. [3] over a shorter sample period.[9] The average director holds about 2 corporate

[9] Adams et al. [3] study director skill sets by exploiting Regulation S-K's 2009 requirement. The rule states that U.S. firms must disclose the qualifications or skills of directors in the Proxy Statements. However, due to data limitations, their sample spans three years whereas our sample spans seventeen years. Adams et al. [3] find 8.1% of outside directors have "academic" skill. Directors from academia or has a higher degree (such as a Ph.D.) are considered as "academic". Their definition is not restrictive to both an academic career and a PhD degree, while our definition requires both. We highlight the importance of the academic career in addition to doctoral degree in our paper.

directorships and is 61 years old. 17% of the directors reach the retirement age of 70.

Panel C reports firm characteristics. The average firm in our sample has about $8 billion in book assets and more than 6 business segments, suggesting that our sample is composed of medium to large firms with multiple divisions. An average firm has 19% of their assets in cash, 22% in leverage, 4% in R&D expenditures, and 6% in capital expenditures. Lastly, Panel D reports CEO characteristics. He and Hirshleifer [61] document that CEOs with doctoral degrees innovate more. If the presence of a PhD CEO and that of an academic director is correlated, PhD CEO could be an omitted variable that we should control for. PhD CEO is defined as a dummy variable that equals one if a CEO has a doctoral degree, and zero otherwise. In our sample, 8% of the firms employ PhD CEOs. An average CEO is 55.7 years old and remains in the job for about 8 years. A CEO owns, on average, 2.15% of the company's shares. Overall, our sample is comparable to samples used in the literature.

Table 2 reports the percentage of firm-year observations with academic directors in 10 of the Fama-French 12 industries. There is a significant representation of academic directors in the innovation industry. More than half of the firms (62%) in the health industry have at least one academic director serving on the board.[10] Similarly, He and Hirshleifer [61] find that PhD CEOs are more common in the health sector. There is also a reasonable representation of academic directors in other industries – firms with at least one academic director constitute about 19% - 32% of the observations in other industries.

[10]As firms need to stay innovative to compete in the health industry, this result hints possible matching between academic directors and firms. That is, firms with innovative needs are more likely to hire academic directors.

1.3 Determinants of Academic Directors

In this section we study the determinants of academic directors. Table 3 compares the characteristics of firms with academic directors to the characteristics of firms without academic directors. The first two columns present the number of observations and means of firm characteristics for firms with academic directors, and the next two columns present the same statistics for firms without. The last two columns report the differences between the means of the two groups and the standard errors of the differences.

We begin by comparing innovation activities and growth options because we find that academic directors are more prevalent in innovative industries. We find that firms with academic directors are associated with higher R&D expenditures (0.047 vs 0.032). The difference is statistically significant and economically meaningful. He and Hirshleifer [61] show that firms with PhD CEOs innovate more. We find that firms with academic directors are 6.8% more likely to be led by PhD CEOs. Using Tobin's Q to measure the value of growth options, firms with academic directors tend to have more valuable growth options.

When comparing other firm characteristics, we find that firms with academic directors tend to be more profitable (higher industry-adjusted ROA) but do not have significantly higher stock returns. These firms are larger, older, and have more business segments. Firms with academic directors use less debt than firms without. The difference is statistically significantly but economically marginal (-1%). Firms with academic directors are less risky, measured by monthly stock return volatility over the past three years. Firms with academic directors are followed by more analysts, but have fewer shares held by institutional investors. Nevertheless, the difference in institutional ownership is economically insignificant.

We then study the determinants of academic directors in a multivariate framework. In Table 4, we report the results of panel Logit models. The dependent variable equals one if a firm has at least one academic board member serving on the board in a given year, and zero otherwise. We separately include a lagged PhD CEO dummy, R&D, industry adjusted ROA, and industry adjusted stock return in Columns (1) - (4), and include all four in the same model in Column (5). We control for lagged firm size, number of segments, Tobin's Q, firm age, leverage, stock return volatility, analyst coverage, and institutional ownership in all columns. Industry fixed effects are included to control for unobserved heterogeneities across industries, as academic directors appear to be more common in the health industry. Year fixed effects are also included to control for common shocks each year. Standard errors are clustered at the firm level.

In Column (1), the independent variable of interest is the PhD CEO dummy. We want to test whether firms led by PhD CEOs are more likely to have academic directors after controlling for firm characteristics. The estimated coefficient of the PhD CEO dummy is positive and statistically significant. The marginal effect reported in the squared brackets indicates that PhD CEO is an economically meaningful determinant of academic directors. Firms led by PhD CEOs are 12.9% more likely to have at least one academic director serving on the board. In Column (2), we replace the PhD CEO dummy with R&D. The estimated coefficient on R&D is positive and significant. For a one standard deviation increase in R&D, firms are 4.7% more likely than the average firm to have academic directors. Results in both columns suggest that innovative firms are more likely to be associated with academic directors.

In Columns (3) and (4), we investigate how a firm's performance is associated with the likelihood that there are academic directors on the board. We use industry median adjusted ROA to measure accounting profitability of firms. The estimated coefficient is negative and significant. This means that firms with low profitability are more likely to have academic directors. When industry median adjusted stock return is used to measure stock market performance, we do not find a significant relationship between stock market performance and the presence of academic directors.

It is possible that the negative and significant coefficient on industry adjusted ROA is caused by omitted variables. For example, high R&D firms tend to have academic directors and lower accounting profits. The positive coefficient on R&D may be driven by the correlation between PhD CEO and R&D (He and Hirshleifer [61]). Hence, we include the PhD CEO dummy, R&D, industry adjusted ROA, and industry adjusted stock return in the same model, and report the results in Column (5). The results for PhD CEO and R&D investments remain robust, but the estimated coefficient on industry adjusted ROA turns insignificant. This indicates that the negative coefficient on industry adjusted ROA found in Column (3) is driven by the correlation between R&D and accounting profits. The coefficients on size and firm age are positive and significant, while the coefficient of leverage is negative and significant. Overall, the results suggest that firms hiring academic directors are larger, older, less leveraged, and more R&D intensive.

1.4 Academic Directors and Innovation Activities

Academic directors by definition are research-oriented. After earning a doctorate, academic directors continue to conduct research and produce innovative research output. Such an exploratory mindset is found to be associated with long-term oriented decisions such as higher investment in R&D (Manso [84], Wulff et al. [109], He and Hirshleifer [61]). An academic director can also advise the executives about specific R&D projects, especially if his research area overlaps with the scope of the projects. Hence, the presence of academic directors should improve firm innovation inputs and outputs. We provide evidence from pooled panel regressions and exogenous director turnovers on the impact of academic directors on firm innovation.

1.4.1 Evidence from Panel Models

We begin by presenting evidence from panel models. We specify a linear panel model with R&D expenditures as the dependent variable. The independent variable of interest is the academic board dummy indicating whether a firm has an academic board member in a given year. We select controls for firm and CEO characteristics following Manso [84], Bena and Li [11] and He and Hirshleifer [61]. We also include the PhD CEO dummy in our model. He and Hirshleifer [61] find that firms with PhD CEOs innovate more. If firms with PhD CEOs are also more likely to hire academic directors, PhD CEOs could be an omitted variable. Thus, it is important to control for PhD CEO in our model when studying academic director's impact on innovation activities. Including the PhD CEO dummy can also help us compare the impact of an academic director to that of a PhD CEO. Lastly, we include an interaction between the academic board dummy and the PhD CEO dummy to test if the co-existence of academic directors and PhD CEOs could strengthen firms' innovative efforts. Industry and year dummies are included to control for unobserved heterogeneities. We report t-stats based on standard errors clustered at firm level.

The results are presented in Table 5. In Column (1), the dependent variable is one-year forward R&D expenses. The estimated coefficient on Academic Board is positive and statistically significant, which supports the hypothesis that academic directors are positively associated with innovation inputs. The effect is economically meaningful. Controlling for all the important determinants of R&D, firms with academic directors invest 0.9 percentage points more of their assets in R&D (22.5% of the sample mean).[11] The coefficient on PhD CEO is also positive and significant, which confirms He and Hirshleifer [61]'s findings. All else equal, firms with PhD CEOs spend 2.5% more in R&D. This effect more than doubles the effect of academic directors, consistent with the fact that a CEO is more directly involved

[11] As reported in Table 1, mean R&D is 4% of book assets in our sample.

in the operations of a firm. Lastly, we do not find that the presence of both a PhD CEO and an academic director affect R&D spending, as the interaction between the two dummies is statistically insignificant.

In Columns (2) and (3), the dependent variables are three-year and five-year forward R&D. We find similar positive and significant coefficients on Academic Board. In Columns (4) - (6), we repeat the analyses in Columns (1) - (3) but replace Academic Board with the fraction of independent directors who are academic directors (% Academic). The results remain robust. The estimated coefficients are positive and statistically significant in all three columns. Overall, the results indicate that academic directors are positively associated with both near-term and long-term innovation inputs.

High R&D expenditures do not necessarily lead to high innovation outputs (e.g., Bena and Li [11]). We cannot conclude that academic directors have a positive impact on firm innovation if they are only associated with high R&D expenditures. To study how academic directors are associated with innovation output, we adopt the empirical methodology in Table 5 and replace the dependent variables with proxies for innovation output.

Table 6 report the results. In Column (1), innovation output is measured by the logarithm of total number of patents filed by a firm in a given year. The coefficient on Academic Board is positive and statistically significant, indicating that firms with at least one academic director are applying for more patents than firms without any academic directors. The coefficient on PhD CEO is also positive and statistically significant, which is consistent with the findings of He and Hirshleifer [61]. The impacts from academic directors and PhD CEOs are both economically meaningful. Ceteris paribus, firms with academic directors on average apply for 22.4% ($= e^{0.202} - 1$) more patents than firms without any academic directors, and firms led by PhD CEOs apply for 48% ($= e^{0.392} - 1$) more patents than firms led by non-PhD CEOs.

In Column (2), the dependent variable is the logarithm of total number of citations. Academic Board is positively associated with the number of citations. Specifically, firms with at least one academic director are associated with 26.5% ($= e^{0.235} - 1$) more citations than firms without any academic directors. In Column (3), we use the logarithm of citation-weighted patent counts to proxy for the output of innovation, following Hall et al. [56] and Kogan et al. [76]. Intuitively, this measure is the "weighted count" of patents – patents that receive more citations are given larger weights.[12] This variable takes a higher value if the firm applies for more patents and it's patents receive more citations. Hence, this variable captures the quality of patents. The positive and significant coefficient on Academic Board suggests that firms with academic directors produce a greater number of important patents. In all three columns, we obtain insignificant coefficients on the interaction between Academic Board and PhD CEO.

In Columns (4) - (6), we replace Academic Board with the fraction of independent directors who are academic directors. We obtain qualitatively similar results. In untabulated results, we find the same relationship between academic directors and innovation after removing firms in the health sector. Hence, our results are not concentrated in the most innovative firms. Overall, the results suggest that academic directors are associated with more innovation outputs. However, academic directors and PhD CEOs do not have an interaction effect on innovation.

Because for firms that have academic directors, more than half have only one academic director, one might question whether one director can make a significant impact on corporate policies given the average board has 9 directors. We interviewed a long-term director and were told that one director can make a difference by raising questions which open board

[12] A detailed definition of Ln(Tcw) is presented in the Appendix. This measure accounts for truncation in citations, as we cannot observe citations received by patents granted during later years of the sample period. The data on forward citations are from Prof. Noah Stoffman's website.

discussions. When a director raises a question, the board will start a discussion around that question. Final decisions will not be carried out until any concerns are properly addressed.

Given one academic director can make a difference, we are interested in knowing whether adding additional academic directors to the board brings extra value. We create two dummy variables. *Academic board–one academic director* equals one if a firm has only one academic director in a given year. *Academic board–more than one academic director* equals one if a firm has two or more academic directors in a given year. We regress innovation input and output measures on these two dummy variables. We follow the same specifications as in Table 6, and report the results in Table B1. The estimated coefficients on *Academic board–one academic director* are positive and significant in all columns. This is consistent with the notion that one academic director is capable of making an impact on firm innovation. The estimated coefficients on *Academic board–more than one academic director* are also positive and significant suggesting that additional academic directors further strengthen firms' innovative efforts.

1.4.2 Evidence from Exogenous Director Turnover

The results so far are consistent with the notion that academic directors improve innovative activities. However, the results are also consistent with innovative firms being more likely to hire academic directors. Reverse causality is a concern. Also, while we control for observable factors influencing both board characteristics and firm innovation such as PhD CEOs, there could still be unobserved omitted variables at work.

To further address endogeneity concerns, we study how firms' innovative activities change following exogenous departures of academic directors. Following prior literature, we argue that changes in the presence of academic directors on boards resulting from academic director deaths are exogenous, i.e., they are unlikely to be caused by firm policy or performance changes (e.g., Nguyen and Nielsen [90], Drobetz et al. [33], Fee et al. [44]).[13] We start by collecting all director deaths during our sample period. We divide these death events into a treatment group, academic director deaths, and a control group, deaths of non-academic directors.

Out of the 24,599 firm-year observations in our panel dataset, we identify 697 death-related director turnovers, 30 of which are turnovers of academic directors. We track any changes in the composition of the board when an academic director departs due to death. Among the 30 academic director turnovers, in two cases a new academic director joins the board in the same year. We drop these cases from the sample because the fraction of academic directors on the board does not change. (There are no cases in which multiple academic directors depart due to death in the same year or multiple academic directors are hired in the same year.) In 13 cases no new director joins and in 15 cases one or more non-academic director joins the board. In both types of cases the fraction of academic directors on the board declines. These 28 cases are considered our treated firms. For each treated firm, we select a close match from the control group of firms which experience a death-related departure of a non-academic director. This is done by narrowing the sample down to control firms that operate in the same industry as the treated firm, and then selecting the control firm that is closest in size to the treated firm. We lose 9 treated firms due to the lack of control firms. Our final sample consists of 19 treated firms and 19 control firms.

For each pair of treatment and control firms, we track their innovation activities three years

[13] One potential concern is that, while director deaths may be exogenous, whether a firm replaces the departing director with an academic or non-academic director is an endogenous choice. We acknowledge this limitation. However, as reported below, firms rarely hire an academic director as replacement following a death-related academic director departure. Among the 30 firms experiencing death-induced academic director turnovers, 2 (6.7%) hire a new academic director while 28 (93.3%) firms do not hire a new director or hire a new non-academic director. For firms that replace the departing director with a non-academic director, it is implausible that almost all firms experiencing an academic director death happen to want to reduce innovation and, as a result, replace the departing director with a non-academic director.

before and two years after the year of the director turnover. We run a difference-in-differences model in which the dependent variable is a proxy for innovation. The independent variable of interest is the interaction between *Academic Director Departure* and *Post*. *Academic Director Departure* equals one for firms experiencing exogenous departures of academic directors, and zero for firms experiencing non-academic director deaths (the treatment dummy). *Post* equals one for the post-turnover years, and zero otherwise (the time dummy). The coefficient on the interaction shows the effect of exogenous departures of academic directors on firms' subsequent innovation activities. We incorporate firm controls in the model. We include firm fixed effects to control for time-invariant firm characteristics and year fixed effects to control for common shocks. The treatment dummy is omitted in the model because it is subsumed by firm fixed effects. Our estimates are based on within firm variations before and after director turnovers.

The results are reported in Table 7. In Columns (1) and (2), the dependent variables are R&D and Ln(Patent). The coefficients on the interaction are negative but statistically insignificant. These suggest that the treatment firms and the control firms have similar changes in R&D and patent counts around director departure. In Columns (3) and (4), the dependent variables are Ln(Cite) and Ln(Tcw). The coefficients on the interaction are negative and significant at the 10% level. These indicate that, relative to firms experiencing non-academic director deaths, firms experiencing academic director deaths have larger reductions in the number citations and the number of important patents. Overall, the results suggest that academic directors do not make companies spend more on R&D, and may not significantly increase patent filings. However, they seem to know which patents are important and guide companies' efforts toward important patents. The results corroborate our hypothesis that academic directors improve firm innovation.

To confirm that our results are not driven by the differences in the pre-trends of the treatment and control firms, we repeat the analyses in Table 7 but interact *Academic Director Departure* with two pre-turnover year dummies and two post-turnover year dummies. If the pre-trends of the treatment firms and the control firms are similar, then the coefficients on the interactions between *Academic Director Departure* and the pre-turnover year dummies should be insignificant. The results are reported in Table C1. The insignificant coefficients on the first two interactions suggest that the pre-trends of the treatment firms and the control firms are not statistically different. By construction, our results are unlikely to be driven by macroeconomic factors because director deaths are happening at different points in time for different firms.

1.4.3 Shocks to Academic Director Busyness: Evidence from Mergers

In the previous section, we provide casual evidence that academic directors improve firm innovation by examining exogenous declines in the fraction of academic directors resulting from academic director deaths. Because death-related departures are rare, one might worry about the small sample, which is being used in the diff-in-diff analysis. Hence, we follow Hauser [60] and employ a quasi-natural experiment that uses board-eliminating mergers to generate shocks to academic director busyness. Intuitively, an academic director becomes less busy when he loses a seat on an acquired board. This would allow him to have more time to fulfill board duties at other companies. If academic directors play important roles in corporate innovation, we should observe an increase in innovation after they lose a board seat on an acquired board.

To study the effect of shocks to academic director busyness on change in innovation, we construct a sample of firms whose directors lose a seat from a board-eliminating merger. We start by searching public firms in BoardEx that are targets of successful mergers in SDC.[14] We find 1461 mergers of target firms and these target firms employed 12,813 directors in the year before the merger. These directors held a total of 8,059 board seats on our sample firms' boards, 4731 of which are on target firms' boards. In the year after the merger, these directors retained 2,195 board seats, and academic directors retained 125 board seats. These directorships are "shocked" by mergers. We create a variable *Shock To Academic Director Busyness* to represent these directorship-years. Lastly, we aggregate this variable from the director level to the firm level so that *Shock To Academic Director Busyness* represents firm-years in which at least one academic director on the board was on a different board that was acquired and terminated.

We estimate a model in which the dependent variable is the change in innovation measures. The independent variable of interest is *Shock To Academic Director Busyness*. This variable equals zero if none of the academic directors on the board experienced board-eliminating mergers. We control for changes in PhD CEO, firm size, firm age, sales growth, Tobin's Q, ROA, leverage, institutional ownership, CEO tenure, CEO age, CEO ownership, and number of analysts. Industry and year fixed effects are included to control for unobserved heterogeneities. T-stats reported are based on standard errors clustered at the firm level.

The results are reported in Table 8. The dependent variables in Column (1) to (4) are changes in R&D, Ln(Patent), Ln(Cite), and Ln(Tcw), respectively. We find an insignificant coefficient on Shock To Academic Director Busyness in Column (1) and positive and significant coefficients on Shock To Academic Director Busyness in Columns (2) - (4). These suggest that relatively to firms whose academic directors do not experience a board-eliminating merger, firms whose academic directors lose a board seat from a merger have similar change in R&D, but larger increases in the number of patents, the number of citations, and citation-

[14] We exclude recapitalizations, exchange offers, repurchases, and privatizations.

weighted patent counts. A shock to academic director busyness is associated with an increase of 8.7% in Ln(Patent), 14% in Ln(Cite), and 10.5% in Ln(Tcw). The magnitude of the effects is smaller than that in Table 7, which is expected because losing an academic director should have a larger impact on innovation. Overall, the results are in line with those in Table 7 and corroborate the hypothesis that academic directors improve firm innovation.

1.4.4 Industry PhD and Academic Directors

In our analyses, we define academic directors as independent directors who hold PhD degrees and pursue academic careers. Some directors pursue industry careers after earning their doctoral degrees. We classify this type of director as an industry PhD director. We hypothesize that industry PhDs are fundamentally different than academic directors and more like other industry-oriented directors. They are hired not because of their degree but because they have industry expertise. Thus, we expect that industry PhDs do not have the same effects as academic directors on firm innovation.[15]

To show that industry PhDs are similar to other industry-oriented directors, we compare the characteristics of industry PhDs to the characteristics of other industry-oriented directors and report the results in Panel A of Table 9. The first two columns report the number and mean of characteristics of industry PhD directors. The next two columns report the same statistics for other independent, industry-oriented directors. In the last three columns, we present the difference between the means of the two groups, the standard error of the differences, and the percentage difference between the means.

A substantial number of industry PhDs have prior CEO or chairman experience. Out of

[15] Industry PhDs can be research-oriented. Ideally, we should separate these research-oriented industry PhDs from other industry PhDs, but this requires substantial data collection. We acknowledge this potential measurement error.

more than 11,000 industry PhD directors, about 51% have already been the CEO, 41% have been the senior executive (i.e., COO, CFO, and President), and 37% have already been the chairman of another company. Only 28.7% of the industry PhD directors have not held an executive or chairman position in the past. When compared with other industry-oriented directors, industry PhD directors are 2.2% more likely to have prior CEO experience, 6.8% less likely to have other executive experience, 4.4% more likely to have chairman experience, and 2.3% more likely to have no prior experience in the top executive or chairman role. Relative to other industry-oriented directors, industry PhD directors are 5.2% less likely to have public firm experience, have worked for about 0.05 fewer companies and sat 0.065 more boards. The average industry PhD director is slightly older than the average industry-oriented director. Although the differences between the means of the two groups are statistically significant, the economic magnitudes are negligible, as indicated by small percentage differences. Overall, industry PhDs are like other industry-oriented directors, having adequate industry experience.

A similar comparison is made between academic directors and industry-oriented directors. Table 9 Panel B reports the results. We find that many academic directors lack industry experience. Only 21% of the academic directors have prior CEO experience, 19% have prior senior executive experience, and 23% have prior chairman experience, while over half (56%) of the academic directors have not held an executive or chairman role. Only a small fraction (15%) of the academic directors have public firm experience, and the average academic director has worked for less than one firm. Academic directors' experiences are in stark contrast with industry-oriented directors'. The differences are both statistically significant and economically large, as demonstrated by large percentage differences. A comparison between the percentage differences in Panel A and those in Panel B indicates that industry PhDs are similar to other industry-oriented directors while academic PhDs are significantly different than other industry-oriented directors. Overall, the results are consistent with the hypothesis that industry PhDs are fundamentally different than academic directors and more like other industry-oriented directors.

Next, we examine how the presence of industry PhD directors affects firm innovation. We create a dummy variable, industry PhD board, which equals one if there is at least one industry PhD director (but no academic director) on the board. We repeat the analyses in Table 5 and Table 6 but substitute the academic board dummy with the industry PhD board dummy. The dependent variables are one-year forward measures of innovation inputs and outputs. The PhD CEO dummy, firm characteristics, industry fixed effects, and year fixed effects are controlled.

Table 9 Panel C reports the results. In Column (1), the dependent variable is R&D expenditures. The estimated coefficient on Industry PhD Board is statistically insignificant, indicating that industry PhD boards are not associated with higher R&D investments. In Column (2), the dependent variable is the logarithm of total number of patents. The insignificant coefficient on Industry PhD Board suggests that industry PhD boards are not significantly associated with a greater number of patents. The dependent variables in Columns (3) and (4) are the logarithm of total number of citations and the logarithm of citation-weighted patent counts. The coefficients on Industry PhD Board are insignificant, which suggest that industry PhD boards are not associated with higher citation counts and a greater number of important patents. Overall, the findings are consistent with our hypothesis that industry PhDs do not have the same effects as academic directors on innovation. The results highlight the importance of the academic career of the directors on firm innovation.

1.4.5 The Advising Channel: Disciplines of Academic Directors

In this and the next subsection we investigate how academic directors can impact corporate innovation. In general, boards exert influences by advising and monitoring corporate executives. We thus examine potential advising and monitoring channels through which academic directors affect innovation. This subsection studies the advising channel. Academic directors' ability to advise the CEO stems from their field of study. Compared with business, economics, law, and other disciplines, the science, technology, engineering, and mathematics (STEM) disciplines are particularly relevant to production technology (White et al. [108]). As such, academic directors in a STEM discipline is more able to advise the CEO on innovative activities and the CEO is also more likely to respect the academic directors' opinions about innovation. Therefore, we hypothesize that academic directors with a STEM background are more likely to affect innovation activities than academic directors with a business, economics, law, or other background.

To collect the information on the field of study of each academic director, we start with BoardEx's data and across check the education file and the employment file. When both files clearly show the same discipline, our keyword-based computer algorithm picks up the discipline directly. Sometimes the language is vague and we have to eyeball the records to define the discipline. Also, because such data are often missing, we supplement by searching the internet based on the director's name and school. Using the collected discipline data, we classify academic directors into three categories: (1) STEM, (2) BUS, and (3) OTH. STEM includes science, technology, engineering, and mathematics. Academic directors with a business, economics or law background are grouped into the BUS category. Those who do not belong to the STEM or the BUS category are classified as OTH.[16] Then, we aggregate classifications from the academic director level to the firm-year level by creating three firm

[16] Some examples of OTH include communication, education, history, international affairs, political science.

dummies. STEM equals one if a firm has at least one STEM academic director. BUS equals one if a firm has at least one academic director with a BUS background. OTH equals one if a firm has at least one academic director with a OTH background.

Table 10, Panel A reports the summary of academic directors' disciplines. Among the 1,032 academic directors in our sample, more than 60% have a background in STEM, 30% are in the fields of business, economics or law, and 8% are from other fields. Thus, a substantial fraction of the academic directors come from a STEM background. Among the 24,599 firm-year observations, 19% have at least one STEM academic director, 14% have at least one academic director with a BUS background, and only 3% have at least one academic director with an OTH background. Thus, the overlaps among the three categories seem quite small at the firm level. We check and verify that there are few occurrences in which a board has academic directors of more than one type of backgrounds.

Next, we investigate how academic directors from different disciplines affect firm innovation. We re-estimate the models in Table 5 and Table 6, replacing the academic board dummy by three dummies each representing boards with at least one academic directors in the STEM, BUS, or OTH disciplines. The dependent variables are one-year forward innovation measures. We control for the PhD dummy, firm characteristics, and CEO characteristics. Industry and year fixed effects are also included.

Table 10, Panel B reports the regression results. In Column (1), the dependent variable is R&D expenses. We find a positive and significant coefficient on the STEM dummy and insignificant coefficients on the BUS dummy and the OTH dummy. These results suggest that STEM academic directors are associated with higher R&D investments but academic directors with a business, economics, law or other background are not significantly associated with higher R&D investments. In Column (2), the dependent variable is the logarithm of total number of patents. The significant coefficient on the STEM dummy suggests that firms with at least one STEM academic director apply for and are later granted more patents than firms without any STEM academic director. Academic directors with a business, economics, law or other background are not significantly associated with more patents.

In Columns (3) and (4), the dependent variables are the logarithm of total number of citations and the logarithm of citation-weighted patent counts. The coefficient estimates on the STEM dummy are positive and significant at the 1% level. These results indicate that firms with at least one STEM academic director are associated with more citations and a greater number of important patents. We do not find academic directors with a business, economics, law or other background to have the same effects, as evidenced by the insignificant coefficients on the BUS dummy and the OTH dummy. Overall, the results suggest that innovation improvements are concentrated in firms with STEM academic directors. The results are consistent with our hypothesis that academic directors with a STEM background are more likely than other directors to improve firm innovation. More importantly, the results suggest that academic directors increase innovation by advising the CEO with their STEM expertise.

1.4.6 The Monitoring Channel

Forced CEO Turnovers

We examine the monitoring channel through which academic directors affect innovation in this subsection. One monitoring channel we consider is whether forced CEO turnovers are tied to innovation when academic directors are present. Due to the risky and long-term nature of innovation investment, CEOs are often reluctant to engage in innovative projects (e.g., Coles et al. [23], Gopalan et al. [52]). Because of this, academic directors may want to use forced CEO turnover as a disciplinary tool to motivate the CEO to innovate. Prior literature suggests that CEO replacement is an important monitoring task of boards (Adams and

Ferreira [4], Eisfeldt and Kuhnen [36], Parrino [92], Peters and Wagner [95], Weisbach [107]). Therefore, we check whether forced CEO turnovers are associated with innovation when academic directors are present. A more negative correlation between innovation and forced CEO turnover at firms with academic directors than at firms without academic directors would be consistent with the monitoring channel.

We obtain forced CEO turnover data from Peters and Wagner [95] and Jenter and Kanaan [68]. Forced CEO turnovers occur in 2.45% of the sample firm-years. We run logit regressions of the forced CEO turnover dummy on *Academic board*, *R&D*, and their interaction. The results are presented in Table 11, Column (1). The control variables include firm performance (industry-adjusted ROA and industry-adjusted stock return), firm size, asset tangibility and other firm characteristics. We also control for CEO characteristics including age, tenure, and ownership, as well as industry and year fixed effects. We find a significantly negative coefficient on the interaction term *Academic board*×*R&D*; that is, the existence of academic directors corresponds to a more negative correlation between R&D and forced CEO turnovers. This result is in line with our hypothesis and suggests that academic directors use CEO replacement as a disciplinary tool to motivate the CEO to innovate. Regarding the control variables, forced CEO turnover is negatively associated with firm performance, CEO age, CEO ownership, and CEO duality, as we would expect.

Because voluntary CEO turnovers are unlikely to result from boards' disciplinary actions, the monitoring channel does not predict a similar result on voluntary CEO turnovers. We check whether this is the case and report the results in Column (2) of Table 11. As we expect, the coefficient on the interaction term *Academic board*×*R&D* is statistically insignificant and economically small. One might worry that R&D expenditures correlate with firm performance and the observed link between CEO turnovers and R&D could be a manifestation of the link between CEO turnovers and firm performance. First of all, we note that R&D is not a significant determinant of forced CEO turnovers on average, as is shown in Column (1) of Table 11. To further alleviate this concern, we additionally control for the interaction between *Academic board* and industry-adjusted ROA or industry-adjusted stock return and report the results in Columns (3)-(5). Our coefficient on *Academic board*$\times$*R&D* remains statistically significant and economically similar with these additional controls. Interestingly, academic directors also correspond to a stronger forced CEO turnover-stock performance sensitivity, suggesting that their monitoring influence perhaps goes beyond innovation promotion.

Earnings Management

Another monitoring channel we consider is whether firms engage less in real earnings management when academic directors are present. Managers have incentives to manage earnings to meet analysts' earnings forecasts (Bartov et al. [9], Graham et al. [53]). Real earnings management boosts earnings through reducing discretionary expenses, manipulating sales at the cost of cash flows, and manipulating COGS expense by overproduction. Reducing discretionary expenses could mean cutting R&D expenses. Manipulating sales at the expense of cash flows and overproducing to lower average production costs would reduce firms' resources. Academic directors put much emphasis on promoting innovation, so they would want to prevent managers from cutting R&D expenses and curb real earnings management so as to conserve resources for innovation. Therefore, we check whether academic directors are associated with greater abnormal R&D expenses, higher abnormal operating cash flows, and lower abnormal production costs, i.e., less real earnings management.

We estimate linear regression models of real earnings management measures on Academic Board while controlling for firm and CEO characteristics. We further include industry and year dummies in all models. The results are reported in Table 12. The dependent variable in Columns (1) is abnormal R&D expenses (Abnormal R&D exp). We find that Academic Board is positively associated with abnormal R&D expenses, which suggests that firms with academic directors engage less in real earnings management through cutting R&D expenses. This is consistent with the hypothesis that academic directors prevent managers from cutting R&D expenses because they put a lot of emphasis on promoting innovation.

While non-R&D expenses can also be used to manage earnings, we do not expect academic directors to pay much attention to them. Consistent with this conjecture, we find that Academic Board is not significantly associated with abnormal discretionary expenses (Abnormal exp, column 2). In Column (3), the dependent variable is abnormal operating cash flows (Abnormal CFO). The coefficient on Academic Board is positive and significant at the 5% level. This indicates that firms with academic directors engage less in real earnings management through manipulating sales at the expense of cash flows. In Column (4), the dependent variable is abnormal production costs (Abnormal prod). Academic Board is associated with lower abnormal production costs suggesting that academic directors are associated with less real earnings management through lowering average production costs by overproduction. Overall, the results are consistent with our hypothesis that academic directors prevent managers from wasting company resources that could otherwise be used for innovation.

Our prediction about the association between academic directors and real earnings management does not apply to accrual based earnings management. In untabulated results, we do not find a significant relationship between academic directors and accrual based earnings management. The lack of result suggests that the relation between academic directors and real earnings management is specific to earnings management practices that waste company resources.

1.5 Academic Directors and Firm Value

In this section, we study firm value implications of academic directors. Academic directors are research-oriented and promote innovation. Greater innovation promoted by academic directors can lead to higher firm value. However, academic directors have undesirable traits. For example, academic directors in general lack industry experience, and less experienced directors have a negative impact on firm value (Ahern and Dittmar [5], Bertrand et al. [12]). Academic directors' areas of specialty may not be directly related to the firms' operations. Additionally, academic directors may stall the decision-making process if they do not see enough supporting evidence. Thus, for the average firm, the value effect of academic directors is not clear. For innovative firms, however, we hypothesize that the value effect of academic directors is positive because academic directors' strength are especially valuable to these firms.

To test our hypothesis, we specify a linear model with the one-year forward logarithm of Tobin's Q as the dependent variable. The independent variable of interest is *Academic board* interacted with an indicator for above-median R&D (*High R&D*). We control for firm and CEO characteristics. Industry and year dummies are included to control for unobserved heterogeneities. Table 13 Column (1) reports the regression result. The coefficient on the interaction term is positive and significant at the 5% level, suggesting that for high R&D firms, the value effect of academic directors is positive. Specifically, academic directors are associated with 5% ($= e^{0.049} - 1$) higher firm value for high R&D firms. In contrast, the coefficient estimate on *Academic board* is negative and insignificant, indicating no value effect of academic directors for low R&D firms. The result is consistent with our hypothesis that academic directors are associated with higher value at firms where innovation is more important.

Next, we consider whether the association between academic directors and firm value differs along other dimensions because as shown in Table 4, firms hiring academic directors are not only more innovative but also larger, older, and less leveraged. We create an indicator for firms that are larger, older, and less leveraged (*Mature firm*). Specifically, we sort firms into deciles by size (ascending order), age (ascending order), and leverage (descending order), assign scores 1 to 10 to each decile, and sum up the scores. A mature firm scored higher than 15. We repeat the analysis in Column (1) but replace *High R&D* by *Mature firm*. Column (2) reports the regression result. The coefficient on the interaction term *Academic board*×*Mature firm* is insignificant. The result remains the same when we additionally control for the innovation status of the firm in Column (3). The results in Columns (2) and (3) indicate no value effect of academic directors for mature firms. Overall, the results suggest that although both innovative firms and mature firms are likely to have academic directors, only innovative firms benefit from having academic directors. It is plausible that mature firms hire academic directors for reasons not related to shareholder value.

Lastly, we considers whether the association between academic directors and firm value at innovative firms differs in academic directors' disciplines. We re-estimate the model in Column (1) replacing the academic board dummy by three dummies each representing boards with at least one academic directors in the STEM, BUS, or OTH disciplines. Column (4) reports the result. We find a positive and significant coefficient only on the interaction between *STEM* and *High R&D*. The result indicates that the academic director-firm value link at innovative firms is concentrated in cases where academic directors have a STEM background.

1.6 Conclusion

In this paper, we study how academic directors affect innovation and firm value. Academic directors have a significant impact on firm innovation input and output. On average, total asset-scaled R&D expenditures are 0.9 to 1 percentage point higher for firms with academic boards than for firms with non-academic boards. Firms with academic boards also produce more patents and patents with greater impacts. A test exploring academic director deaths and another utilizing shocks to academic director busyness due to mergers suggest that the relation between academic directors and patent applications is causal. We find evidence that the impact of academic directors on innovation is exerted through both advising and monitoring channels. Finally, academic directors are associated with higher firm value at innovative firms where innovation is more valuable.

To the best of our knowledge, this paper is the first to offer a detailed analysis of the impacts of academic directors on innovation. Despite the lack of attention on academic directors in prior research and public media, we discover that they sit on the boards of a non-trivial number of companies and in almost all industries. Furthermore, we find that academic directors, through advising and monitoring channels, help spur corporate innovation. Academic directors are also associated with higher firm value at innovative firms. Our paper makes important contributions to both the literature on the real effects of board characteristics and the literature about the impact of corporate governance on innovation.

1.7 Tables

Table 1: Summary Statistics

This table reports summary statistics for board, director, firm, and CEO characteristics. Our sample is an unbalanced panel consisting of 221,475 directorships in 24,599 firm-years on 2,120 unique firms from 2000 to 2017. All continuous variables are winsorized at the 1^{st} and 99^{th} percentiles. Detailed variable definitions are reported in the Appendix.

	Count	Mean	S.D.	25th Percentile	Median	75th Percentile
Board Characteristics						
Academic board	24599	0.31	0.46	0.00	0.00	1.00
% Academic	24573	0.06	0.10	0.00	0.00	0.13
Board size	24599	9.00	2.19	7.00	9.00	10.00
% Independent	24599	0.76	0.14	0.67	0.80	0.88
CEO duality	24121	0.51	0.50	0.00	1.00	1.00
Director Characteristics						
Academic director	221475	0.05	0.21	0.00	0.00	0.00
# Directorships	221456	1.95	1.31	1.00	2.00	3.00
Director tenure	221475	8.43	7.83	2.70	6.30	11.80
Director age	215985	60.85	8.89	55.00	61.00	67.00
Retirement age	221475	0.17	0.38	0.00	0.00	0.00
Firm Characteristics						
Assets ($mil)	24599	7915.61	19209.25	672.34	1832.96	5717.98
Age	24599	23.34	19.07	10.00	18.00	32.00
# Segments	24599	6.62	5.33	3.00	4.00	10.00
Tobin's Q	24597	2.03	1.29	1.22	1.63	2.36
ROA	24590	0.05	0.11	0.02	0.06	0.10
Stock return	24569	0.16	0.49	-0.14	0.10	0.36
Volatility	24528	0.13	0.06	0.09	0.11	0.15
Sales growth	24572	0.10	0.24	-0.01	0.07	0.17
Cash	24599	0.19	0.21	0.04	0.11	0.26
Leverage	24599	0.22	0.19	0.04	0.20	0.34
R&D	24590	0.04	0.06	0.00	0.00	0.05
Ln(Patent)	24599	1.15	1.71	0.00	0.00	2.08
ln(Cite)	24599	1.63	2.46	0.00	0.00	3.14
ln(Tcw)	24599	1.04	1.71	0.00	0.00	1.70
CAPX	24541	0.06	0.06	0.02	0.04	0.07
Dividend	24590	0.01	0.02	0.00	0.00	0.02
Repurchase	24590	0.03	0.06	0.00	0.00	0.04
Stock issues	23916	0.03	0.08	0.00	0.01	0.02
Institutional ownership	24110	0.76	0.24	0.65	0.81	0.91
# Analyst	24599	10.01	7.60	4.00	8.00	14.00
CEO Characteristics						
PhD CEO	23349	0.08	0.27	0.00	0.00	0.00
CEO tenure	23835	8.22	7.08	3.00	6.00	11.00
CEO age	23660	55.73	7.24	51.00	56.00	60.00
CEO ownership	23769	2.15	5.23	0.11	0.36	1.24

Table 2: Industry Distribution of Academic Directors

This table reports the industry distribution of academic directors. For 10 of the Fama-French 12 industries, we report the percentage of firm-year observations that have at least one academic director. The financial sector (SIC between 6000-6999) and the utility sector (SIC between 4900-4949) are excluded from the sample.

Industry	Percentage	Industry	Percentage
Health	61.89%	Other	26.35%
Chemicals	31.80%	Shops	25.25%
Consumer Nondurables	31.67%	Telecommunication	24.42%
Business Equipment	30.11%	Energy	18.64%
Manufacturing	28.92%		
Consumer Durables	26.48%		

Table 3: Firms with Academic Directors vs. Firms without

This table compares the characteristics of firms that have at least one academic board member with those of firms that do not have any for the sample of 24,599 firm-years over the period of 2000-2017. The first two columns present the number of observations and means of firm characteristics for firms with academic directors, and the next two columns present the same statistics for firms without. The last two columns report the differences between the means of the two groups and the standard errors of the differences. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. Detailed variable definitions are reported in the Appendix. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	Academic board = 1		Academic board = 0			
	N	Mean	N	Mean	Diff.	S.E.
R&D	7708	0.047	16882	0.032	0.015***	0.001
PhD CEO	7364	0.124	15985	0.056	0.068***	0.004
Ln(Tobin's Q)	7710	1.067	16887	1.034	0.033***	0.005
Ind-adj. ROA	7708	0.046	16882	0.032	0.014***	0.002
Ind-adj. stock return	7705	0.106	16864	0.114	-0.008	0.006
Size	7710	7.953	16889	7.481	0.472***	0.022
Age	7710	26.703	16889	21.793	4.910***	0.260
# Segments	7710	7.038	16889	6.436	0.602***	0.073
Leverage	7710	0.215	16889	0.225	-0.011***	0.003
Volatility	7698	0.122	16829	0.130	-0.008***	0.001
# Analyst	7710	10.974	16889	9.575	1.400***	0.104
Institutional ownership	7581	0.750	16529	0.759	-0.008**	0.003

Table 4: Determinants of Academic Board

This table reports the coefficient estimates of pooled panel Logistic regressions that examine the determinants of academic directors. The dependent variable is a dummy variable that equals one if the firm has at least one academic director sitting on the board in a given year, and zero otherwise. PhD CEO, R&D, Ind-adj. ROA, and Ind-adj. stock return are separately included as independent variables in Columns (1) - (4), and are all included in Column (5). Additional firm characteristics, industry fixed effects, and year fixed effects are controlled in all models. More detailed definitions of variables are reported in the Appendix. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	Academic dummy (1)	Academic dummy (2)	Academic dummy (3)	Academic dummy (4)	Academic dummy (5)
PhD CEO$_{t-1}$	0.676***				0.572***
	(4.57)				(3.84)
R&D$_{t-1}$		4.089***			3.756***
		(5.44)			(4.67)
Ind-adj. ROA$_{t-1}$			-0.712***		0.015
			(-2.73)		(0.06)
Ind-adj. stock return$_{t-1}$				-0.056	-0.031
				(-1.45)	(-0.79)
Size$_{t-1}$	0.279***	0.299***	0.284***	0.280***	0.303***
	(6.30)	(6.76)	(6.43)	(6.32)	(6.73)
# Segments$_{t-1}$	-0.002	0.001	-0.001	-0.001	-0.000
	(-0.21)	(0.10)	(-0.08)	(-0.09)	(-0.01)
Ln(Tobin's Q)$_{t-1}$	0.234*	0.084	0.357***	0.293**	0.094
	(1.79)	(0.65)	(2.68)	(2.10)	(0.63)
Ln(Age)$_{t-1}$	0.181***	0.170***	0.165***	0.167***	0.184***
	(3.23)	(3.14)	(3.05)	(3.08)	(3.28)
Leverage$_{t-1}$	-0.769***	-0.667**	-0.805***	-0.743***	-0.697***
	(-2.97)	(-2.57)	(-3.15)	(-2.94)	(-2.62)
Volatility$_{t-1}$	0.283	-0.898	-0.116	0.258	-0.610
	(0.37)	(-1.19)	(-0.16)	(0.35)	(-0.77)
# Analyst$_{t-1}$	0.004	-0.001	0.003	0.003	-0.001
	(0.56)	(-0.12)	(0.36)	(0.36)	(-0.08)
Institutional ownership$_{t-1}$	-0.352**	-0.357**	-0.356**	-0.394**	-0.327*
	(-2.05)	(-2.10)	(-2.10)	(-2.34)	(-1.87)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
N	20744	21758	21758	21761	20733
pseudo R^2	0.101	0.102	0.096	0.096	0.107

Table 5: Academic Board and R&D Expenditures

This table reports the coefficient estimates of pooled panel regressions that examine the effect of academic directors on R&D expenditures. The dependent variables are one-, three-, and five-year forward R&D expenses (XRD) scaled by book assets (AT). The independent variable of interest is the academic board dummy in Columns (1) to (3) and the fraction of academic directors in Columns (4) to (6). We control for PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	R&D$_{t+1}$ (1)	R&D$_{t+3}$ (2)	R&D$_{t+5}$ (3)	R&D$_{t+1}$ (4)	R&D$_{t+3}$ (5)	R&D$_{t+5}$ (6)
Academic board	0.009***	0.009***	0.010***			
	(4.64)	(4.71)	(4.75)			
Academic board×PhD CEO	0.004	0.006	0.004			
	(0.50)	(0.69)	(0.38)			
% Academic				0.047***	0.046***	0.049***
				(4.49)	(4.30)	(4.26)
% Academic×PhD CEO				0.011	0.018	0.016
				(0.32)	(0.47)	(0.39)
PhD CEO	0.025***	0.023***	0.026***	0.024***	0.023***	0.025***
	(4.25)	(4.06)	(4.05)	(4.42)	(4.21)	(4.07)
Size	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***	-0.006***
	(-7.70)	(-6.92)	(-6.57)	(-7.62)	(-6.80)	(-6.43)
Ln(Age)	-0.000	-0.000	-0.001	-0.000	-0.000	-0.001
	(-0.33)	(-0.49)	(-0.74)	(-0.20)	(-0.32)	(-0.57)
Sales growth	0.013***	0.011***	0.010***	0.013***	0.011***	0.010***
	(4.96)	(4.15)	(3.20)	(5.14)	(4.20)	(3.25)
Ln(Tobin's Q)	0.056***	0.046***	0.041***	0.056***	0.046***	0.040***
	(15.80)	(12.74)	(10.22)	(15.75)	(12.65)	(10.09)
ROA	-0.175***	-0.164***	-0.154***	-0.175***	-0.164***	-0.153***
	(-15.39)	(-13.81)	(-11.01)	(-15.55)	(-13.90)	(-11.04)
Leverage	-0.033***	-0.030***	-0.027***	-0.032***	-0.029***	-0.026***
	(-7.11)	(-5.57)	(-4.43)	(-7.00)	(-5.47)	(-4.29)
Institutional ownership	-0.006*	-0.004	-0.003	-0.006	-0.004	-0.003
	(-1.77)	(-0.99)	(-0.68)	(-1.64)	(-0.93)	(-0.64)
Ln(CEO tenure)	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***
	(3.45)	(3.27)	(2.69)	(3.39)	(3.25)	(2.71)
Ln(CEO age)	-0.033***	-0.036***	-0.038***	-0.033***	-0.036***	-0.038***
	(-4.60)	(-4.75)	(-4.63)	(-4.61)	(-4.76)	(-4.64)
CEO ownership	-0.000*	-0.000	-0.000	-0.000*	-0.000	-0.000
	(-1.75)	(-0.99)	(-0.43)	(-1.83)	(-1.09)	(-0.53)
Ln(# Analyst)	0.009***	0.009***	0.010***	0.009***	0.009***	0.010***
	(6.96)	(6.57)	(6.80)	(7.04)	(6.64)	(6.90)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	20791	16973	13494	20777	16961	13482
R^2	0.506	0.488	0.470	0.509	0.490	0.473

Table 6: Academic Board and Innovation Output

This table reports the coefficients estimates of pooled panel regressions that examine the effect of academic director on firms innovation outputs. The dependent variables in Columns (1) and (4) are one-year forward logarithm of one plus total number of patents (Ln(Patent)). The dependent variables in Columns (2) and (5) are one-year forward logarithm of one plus total number of citations (Ln(Cite)). The dependent variables in Columns (3) and (6) are one-year forward citation-weighted patent counts (Ln(Tcw)). The independent variable of interest is the academic board dummy in Columns (1) to (3) and the fraction of academic directors in Columns (4) to (6). We control for PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	Ln(Patent)	Ln(Cite)	Ln(Tcw)	Ln(Patent)	Ln(Cite)	Ln(Tcw)
	(1)	(2)	(3)	(4)	(5)	(6)
Academic board	0.202***	0.235***	0.206***			
	(3.51)	(3.14)	(3.54)			
Academic board×PhD CEO	-0.007	0.030	-0.016			
	(-0.04)	(0.13)	(-0.09)			
% Academic				0.982***	1.286***	1.097***
				(3.41)	(3.45)	(3.78)
% Academic×PhD CEO				-0.878	-0.969	-0.958
				(-1.43)	(-1.15)	(-1.50)
PhD CEO	0.392***	0.543***	0.367***	0.478***	0.650***	0.454***
	(3.37)	(3.20)	(2.87)	(4.23)	(4.15)	(3.72)
Size	0.469***	0.548***	0.444***	0.471***	0.550***	0.446***
	(15.37)	(14.56)	(14.36)	(15.46)	(14.63)	(14.42)
Ln(Age)	0.165***	0.142***	0.107***	0.170***	0.148***	0.112***
	(5.50)	(3.64)	(3.56)	(5.64)	(3.81)	(3.73)
Sales growth	-0.023	0.017	0.011	-0.024	0.010	0.006
	(-0.46)	(0.23)	(0.19)	(-0.48)	(0.14)	(0.11)
Ln(Tobin's Q)	0.906***	1.235***	0.972***	0.910***	1.239***	0.975***
	(11.27)	(11.22)	(11.06)	(11.26)	(11.23)	(11.06)
ROA	-1.096***	-1.746***	-1.119***	-1.099***	-1.728***	-1.110***
	(-6.68)	(-7.12)	(-5.96)	(-6.71)	(-7.12)	(-5.95)
Leverage	-0.912***	-1.093***	-0.867***	-0.903***	-1.070***	-0.851***
	(-6.90)	(-6.21)	(-6.30)	(-6.79)	(-6.06)	(-6.15)
Institutional ownership	-0.432***	-0.554***	-0.465***	-0.430***	-0.549***	-0.460***
	(-4.41)	(-4.54)	(-4.83)	(-4.38)	(-4.51)	(-4.78)
Ln(CEO tenure)	0.007	-0.003	0.020	0.007	-0.003	0.021
	(0.24)	(-0.09)	(0.67)	(0.26)	(-0.07)	(0.69)
Ln(CEO age)	-0.877***	-0.966***	-0.841***	-0.884***	-0.984***	-0.852***
	(-4.49)	(-3.59)	(-4.05)	(-4.51)	(-3.65)	(-4.10)
CEO ownership	0.001	-0.001	0.001	0.000	-0.001	0.000
	(0.12)	(-0.16)	(0.14)	(0.08)	(-0.19)	(0.09)
Ln(# Analyst)	0.195***	0.276***	0.205***	0.197***	0.278***	0.206***
	(5.41)	(5.93)	(5.70)	(5.46)	(5.98)	(5.76)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	21490	21490	21490	21472	21472	21472
R^2	0.511	0.482	0.460	0.511	0.483	0.461

Table 7: Evidence from Exogenous Director Turnovers

This table reports the coefficient estimates of pooled fixed effects regressions that examine the effect of exogenous declines in the fraction of academic directors caused by academic director deaths on innovation. The dependent variables in Columns (1) to (4) are one-year forward measures of R&D, the logarithm of one plus total number of patents (Ln(Patent)), the logarithm of one plus total number of citations (Ln(Cite)), and the logarithm of one plus citation-weighted patent counts (Ln(Tcw)), respectively. We specify diff-in-diff models by creating a time dummy and a treatment dummy. The time dummy equals one for post-turnover years, and zero otherwise (Post). The treatment dummy equals one for firms experiencing academic director deaths, and zero for firms experiencing non-academic director deaths (Academic Director Departure). The independent variable of interest is *Academic Director Departure×Post*. We control for Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, and Ln(# Analyst), PhD CEO. More detailed definitions of variables are reported in the Appendix. Firm and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	R&D (1)	Ln(Patent) (2)	Ln(Cite) (3)	Ln(Tcw) (4)
Academic Director Departure×Post	-0.003	-0.094	-0.777*	-0.307*
	(-0.33)	(-0.63)	(-1.92)	(-1.72)
Post	0.010	0.134	0.386	0.155
	(0.72)	(0.91)	(1.33)	(0.77)
Size	-0.078	-0.024	-0.388	0.031
	(-1.53)	(-0.13)	(-0.86)	(0.13)
Ln(Age)	0.040	-0.376	0.830	0.129
	(1.33)	(-1.08)	(0.88)	(0.35)
Sales growth	0.005	-0.130	-0.358	-0.123
	(0.24)	(-0.63)	(-0.91)	(-0.52)
Ln(Tobin's Q)	0.004	-0.271	0.240	0.101
	(0.08)	(-0.74)	(0.37)	(0.31)
ROA	0.033	-0.118	-0.450	-0.560
	(0.35)	(-0.22)	(-0.67)	(-1.43)
Leverage	-0.027	-0.140	0.624	0.306
	(-0.51)	(-0.29)	(0.68)	(0.54)
Institutional ownership	-0.033	0.296	1.867**	0.912*
	(-0.54)	(0.89)	(2.33)	(1.83)
Ln(# Analyst)	-0.010	0.204	-0.031	0.132
	(-0.73)	(0.97)	(-0.07)	(0.59)
PhD CEO	0.042	-0.254	-0.600	-0.451
	(0.90)	(-0.57)	(-0.90)	(-1.01)
Firm & Year FE	Yes	Yes	Yes	Yes
N	168	168	168	168
R^2	0.895	0.964	0.931	0.957

Table 8: Shocks to Academic Director Busyness: Evidence from Mergers

This table reports the regression results examining the effect of shocks to academic director busyness on change in innovation. The dependent variables in Columns (1) to (4) are changes in R&D, the logarithm of one plus total number of patents (Ln(Patent)), the logarithm of one plus total number of citations (Ln(Cite)), and the logarithm of one plus citation-weighted patent counts (Ln(Tcw)), respectively. Shock To Academic Director Busyness is the number of cases an academic director on a board was on a different board that was acquired and terminated (Hauser [60]). We control for changes in PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	ΔR&D (1)	ΔLn(Patent) (2)	ΔLn(Cite) (3)	ΔLn(Tcw) (4)
Shock To Academic Director Busyness	-0.004	0.087*	0.140*	0.105*
	(-1.09)	(1.77)	(1.84)	(1.76)
ΔPhD CEO	0.009*	-0.004	-0.121	-0.090
	(1.77)	(-0.08)	(-1.45)	(-1.50)
ΔSize	0.016***	0.083**	0.040	0.020
	(3.74)	(2.11)	(0.65)	(0.47)
ΔLn(Age)	-0.007**	0.280**	0.321***	0.192**
	(-2.21)	(2.22)	(3.15)	(2.16)
ΔSales growth	0.019***	-0.070**	-0.032	-0.047
	(6.15)	(-2.36)	(-0.54)	(-1.17)
ΔLn(Tobin's Q)	0.006	-0.014	-0.039	-0.032
	(1.61)	(-0.29)	(-0.41)	(-0.52)
ΔROA	-0.056***	0.071	0.151	0.069
	(-4.29)	(0.82)	(0.83)	(0.57)
ΔLeverage	0.001	-0.173*	-0.239	-0.187
	(0.05)	(-1.70)	(-1.13)	(-1.48)
ΔInstitutional ownership	-0.003	-0.079	-0.066	-0.082
	(-1.02)	(-1.39)	(-0.71)	(-1.26)
ΔLn(CEO tenure)	-0.001	-0.002	-0.036	-0.005
	(-0.98)	(-0.08)	(-0.98)	(-0.21)
ΔLn(CEO age)	-0.005	0.067	0.321	0.123
	(-0.68)	(0.41)	(1.16)	(0.67)
ΔLn(CEO ownership)	0.000*	-0.011**	-0.008	-0.006
	(1.72)	(-1.98)	(-0.97)	(-1.03)
ΔLn(# Analyst)	-0.002**	0.021	0.040	0.033*
	(-2.15)	(1.35)	(1.35)	(1.71)
Industry & Year FE	Yes	Yes	Yes	Yes
N	6289	6289	6289	6289
R^2	0.086	0.024	0.029	0.018

Table 9: Industry PhD Board and Firm Innovation

This table compares industry PhD directors vs other industry-oriented directors and academic directors vs other industry-oriented directors to show that academic directors are different than industry directors. Panel (a) compares the characteristics of industry PhD and those of other industry-oriented directors. Panel (b) compares the characteristics of academic directors and those of other industry-oriented directors. For both panels, we report the number of observations (N), the mean of each group (Mean), the differences between the means (Diff.), the standard errors of the differences (S.E.), and the percentage differences (Diff. (%)). Panel (c) reports the coefficient estimates of pooled panel regressions that examine the effect of industry PhD board on firm innovation. The dependent variables in Columns (1) to (4) are one-year forward measures of R&D, the logarithm of one plus total number of patents (Ln(Patent)), the logarithm of one plus total number of citations (Ln(Cite)), and the logarithm of one plus citation-weighted patent counts (Ln(Tcw)), respectively. Industry PhD board is a dummy variable equal to one if there is at least one industry PhD director (but not academic director) on the board. We control for PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

(a) Comparison Between Industry PhD and Other Industry-Oriented Directors

	Industry PhD		Other Industry-Oriented Directors				
	N	Mean	N	Mean	Diff.	S.E.	**Diff.(%)**
CEO experience	11049	0.512	164552	0.490	0.022***	0.00	**4.49%**
Other exec experience	11049	0.407	164552	0.475	-0.068***	0.00	**-14.32%**
Chairman experience	11049	0.366	164552	0.322	0.044***	0.00	**13.66%**
No role	11049	0.287	164552	0.265	0.023***	0.00	**8.68%**
Public experience	11049	0.394	164552	0.445	-0.052***	0.00	**-11.69%**
# Company	11049	1.806	164552	1.859	-0.053***	0.02	**-2.85%**
# Directorships	11049	2.096	164537	2.031	0.065***	0.01	**3.20%**
Director tenure	11049	8.077	164552	8.036	0.041	0.07	**0.51%**
Director age	11046	63.440	159737	61.471	1.969***	0.09	**3.20%**
Retirement age	11049	0.199	164552	0.171	0.029***	0.00	**16.96%**

(b) Comparison Between Academic PhD and Other Industry-Oriented Directors

	Academic PhD		Other Industry-Oriented Directors				
	N	Mean	N	Mean	Diff.	S.E.	**Diff.(%)**
CEO experience	10254	0.213	164552	0.490	-0.278***	0.01	**-56.73%**
Other exec experience	10254	0.190	164552	0.475	-0.285***	0.01	**-60.00%**
Chairman experience	10254	0.233	164552	0.322	-0.089***	0.00	**-27.64%**
No role	10254	0.560	164552	0.265	0.295***	0.00	**111.32%**
Public experience	10254	0.150	164552	0.445	-0.296***	0.00	**-66.52%**
# Company	10254	0.831	164552	1.859	-1.028***	0.02	**-55.30%**
# Directorships	10254	2.122	164537	2.031	0.092***	0.01	**4.53%**
Director tenure	10254	8.224	164552	8.036	0.188**	0.07	**2.34%**
Director age	10253	63.829	159737	61.471	2.358***	0.09	**3.84%**
Retirement age	10254	0.224	164552	0.171	0.053***	0.00	**30.99%**

(c) Panel Regressions

	R&D (1)	Ln(Patent) (2)	Ln(Cite) (3)	Ln(Tcw) (4)
Industry PhD board	0.000	-0.065	-0.056	-0.068
	(0.20)	(-1.16)	(-0.75)	(-1.21)
PhD CEO	0.030***	0.419***	0.590***	0.393***
	(6.29)	(3.96)	(4.04)	(3.47)
Industry PhD board×PhD CEO	-0.005	-0.004	0.006	-0.017
	(-0.55)	(-0.02)	(0.02)	(-0.09)
Size	-0.006***	0.480***	0.562***	0.456***
	(-7.22)	(15.57)	(14.73)	(14.53)
Ln(Age)	-0.000	0.173***	0.151***	0.115***
	(-0.06)	(5.74)	(3.87)	(3.83)
Sales growth	0.011***	-0.027	0.012	0.006
	(4.49)	(-0.54)	(0.16)	(0.11)
Ln(Tobin's Q)	0.054***	0.920***	1.253***	0.986***
	(15.28)	(11.29)	(11.26)	(11.10)
ROA	-0.166***	-1.133***	-1.789***	-1.156***
	(-15.06)	(-6.89)	(-7.30)	(-6.15)
Leverage	-0.034***	-0.944***	-1.131***	-0.898***
	(-7.53)	(-7.14)	(-6.44)	(-6.53)
Institutional ownership	-0.008**	-0.446***	-0.569***	-0.478***
	(-2.17)	(-4.52)	(-4.64)	(-4.94)
Ln(CEO tenure)	0.004***	0.009	-0.000	0.023
	(3.23)	(0.33)	(-0.01)	(0.75)
Ln(CEO age)	-0.032***	-0.857***	-0.942***	-0.820***
	(-4.59)	(-4.39)	(-3.51)	(-3.96)
CEO ownership	-0.000*	0.000	-0.001	0.000
	(-1.85)	(0.05)	(-0.20)	(0.07)
Ln(# Analyst)	0.009***	0.196***	0.277***	0.206***
	(7.20)	(5.40)	(5.92)	(5.68)
Industry & Year FE	Yes	Yes	Yes	Yes
N	21489	21490	21490	21490
R^2	0.495	0.508	0.481	0.458

Table 10: Academic Directors' Disciplines and Firm Innovation

This table reports the coefficient estimates of pooled OLS regressions that examine how academic directors' areas of expertise affect firm innovation. We collect the information on the field of study of each academic director and classify academic directors into three general groups based on their disciplines: STEM, BUS, OTH. Academic directors with a medicine, science, technology, engineering or mathematics background are grouped into the STEM category. BUS includes business, economics, and law. OTH includes disciplines that do not fall into either the STEM category or the BUS category. Then, we aggregate director disciplines to the firm level by creating three firm dummies. STEM equals one if the firm has at least one academic director with a STEM background. BUS equals one if the firm has at least one academic director with a BUS background. Finally, OTH equals one if the firm has at least one academic director with an OTH background. In Panel A, we present the summary statistics of director disciplines and firm dummies. In Panel B, we replicate Table 5 and Table 6, replacing the academic board dummy with the STEM, BUS and OTH dummy. We control for PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

Panel A: Summary of Disciplines

	Count	Mean	S.D.	25th Percentile	Median	75th Percentile
Academic Director Level						
STEM	1032	0.62	0.48	0.00	1.00	1.00
BUS	1032	0.30	0.46	0.00	0.00	1.00
OTH	1032	0.08	0.27	0.00	0.00	0.00
Firm-Year Level						
STEM	24599	0.19	0.40	0.00	0.00	0.00
BUS	24599	0.14	0.34	0.00	0.00	0.00
OTH	24599	0.03	0.17	0.00	0.00	0.00

Table 10: Academic Directors' Disciplines and Firm Innovation

Panel B: Panel Regressions

	R&D (1)	Ln(Patent) (2)	Ln(Cite) (3)	Ln(Tcw) (4)
STEM	0.017***	0.382***	0.531***	0.418***
	(6.80)	(5.01)	(5.31)	(5.29)
BUS	-0.001	0.065	0.015	0.041
	(-0.57)	(0.87)	(0.16)	(0.56)
OTH	0.003	0.112	0.125	0.133
	(0.65)	(0.73)	(0.61)	(0.89)
PhD CEO	0.026***	0.348***	0.500***	0.314***
	(6.00)	(3.57)	(3.79)	(3.06)
Size	-0.007***	0.458***	0.534***	0.433***
	(-8.36)	(15.15)	(14.30)	(14.12)
Ln(Age)	-0.000	0.166***	0.144***	0.108***
	(-0.23)	(5.60)	(3.75)	(3.66)
Sales growth	0.011***	-0.025	0.013	0.008
	(4.57)	(-0.51)	(0.18)	(0.15)
Ln(Tobin's Q)	0.052***	0.875***	1.187***	0.936***
	(15.22)	(11.04)	(11.03)	(10.91)
ROA	-0.162***	-1.040***	-1.660***	-1.055***
	(-15.25)	(-6.36)	(-6.84)	(-5.69)
Leverage	-0.033***	-0.899***	-1.071***	-0.849***
	(-7.20)	(-6.80)	(-6.09)	(-6.18)
Institutional ownership	-0.007**	-0.426***	-0.547***	-0.458***
	(-2.01)	(-4.36)	(-4.50)	(-4.79)
Ln(CEO tenure)	0.003***	0.004	-0.008	0.017
	(3.03)	(0.14)	(-0.21)	(0.55)
Ln(CEO age)	-0.034***	-0.891***	-0.988***	-0.857***
	(-4.85)	(-4.57)	(-3.68)	(-4.15)
CEO ownership	-0.000*	0.001	-0.000	0.001
	(-1.75)	(0.21)	(-0.06)	(0.24)
Ln(# Analyst)	0.009***	0.195***	0.275***	0.204***
	(7.30)	(5.44)	(5.96)	(5.72)
Industry & Year FE	Yes	Yes	Yes	Yes
N	21489	21490	21490	21490
R^2	0.504	0.514	0.487	0.465

Table 11: CEO Turnover Sensitivity to Innovation

This table reports the coefficient estimates of pooled panel Logistic regressions that examine the effect of academic director on CEO's turnover sensitivity to innovation. The dependent variables in Columns (1), (3)-(5) equal one if there is a forced CEO turnover in a given year, and zero otherwise. The dependent variable in Columns (2) equals one if there is a voluntary CEO turnover in a given year, and zero otherwise. Forced CEO turnover data are from Peters and Wagner [95] and Jenter and Kanaan [68] and are available from 1993 to 2016. The sample used in this table ranges from 2000 to 2016. We control for R&D, Board size, % Independent, CEO duality, Size, Ln(Age), Tangibility, Ind-adj. ROA, Ind-adj. stock return, Leverage, Ln(CEO age), Ln(CEO tenure), CEO ownership. More detailed definitions of variables are reported in the Appendix. Industry fixed effects and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	Forced (1)	Voluntary (2)	Forced (3)	Forced (4)	Forced (5)
Academic board×R&D	-3.554**	-0.971	-3.007*	-4.033**	-2.962*
	(-2.26)	(-0.94)	(-1.81)	(-2.55)	(-1.77)
Academic board	-0.021	-0.116	-0.023	-0.135	-0.174
	(-0.17)	(-1.58)	(-0.18)	(-0.96)	(-1.20)
R&D	-1.339	0.114	-1.466	-1.271	-1.549
	(-1.21)	(0.15)	(-1.31)	(-1.15)	(-1.38)
Board size	-0.022	0.050***	-0.022	-0.023	-0.024
	(-0.64)	(2.64)	(-0.64)	(-0.66)	(-0.68)
% Independent	0.697	-0.999***	0.700	0.682	0.688
	(1.44)	(-3.44)	(1.45)	(1.41)	(1.43)
CEO duality	-0.557***	0.193***	-0.559***	-0.551***	-0.554***
	(-4.55)	(2.81)	(-4.55)	(-4.51)	(-4.52)
Size	0.038	0.008	0.036	0.046	0.043
	(0.72)	(0.29)	(0.68)	(0.87)	(0.82)
Ln(Age)	0.100	-0.115***	0.100	0.100	0.102
	(1.56)	(-3.11)	(1.57)	(1.57)	(1.60)
Tangibility	-0.059	-0.079	-0.043	-0.067	-0.035
	(-0.20)	(-0.45)	(-0.14)	(-0.23)	(-0.12)
Ind-adj. ROA	-4.352***	-1.096***	-4.604***	-4.358***	-4.939***
	(-9.06)	(-3.34)	(-8.75)	(-9.08)	(-9.21)
Academic board×Ind-adj. ROA			0.960		2.202**
			(1.01)		(2.19)
Ind-adj. stock return	-1.337***	-0.334***	-1.333***	-1.071***	-0.990***
	(-5.88)	(-4.15)	(-5.87)	(-4.39)	(-4.10)
Academic board×Ind-adj. stock return				-1.222***	-1.582***
				(-2.89)	(-3.41)
Leverage	-0.098	-0.080	-0.095	-0.129	-0.128
	(-0.36)	(-0.42)	(-0.35)	(-0.48)	(-0.47)
Ln(CEO age)	-0.851*	6.346***	-0.859**	-0.901**	-0.933**
	(-1.94)	(18.90)	(-1.96)	(-2.05)	(-2.13)
Ln(CEO tenure)	0.114*	0.145***	0.115*	0.120*	0.122*
	(1.65)	(3.35)	(1.66)	(1.74)	(1.76)
CEO ownership	-0.175***	-0.075***	-0.175***	-0.174***	-0.176***
	(-3.39)	(-7.22)	(-3.42)	(-3.38)	(-3.42)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes
N	18737	19449	18737	18737	18737
pseudo R^2	0.126	0.094	0.126	0.129	0.130

Table 12: Earnings Management

This table reports the coefficient estimates of pooled panel linear regressions that examine the effect of academic directors on accrual based and real earnings management. The dependent variables in columns (1) to (4) are abnormal R&D expenses (Abnormal R&D exp), abnormal discretionary expenses (Abnormal exp), abnormal operating cash flow (Abnormal CFO), and abnormal production costs (Abnormal prod), respectively. We control for PhD CEO, Size, Ln(Age), sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional Ownership Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analysts). More detailed definitions of variables are reported in the Appendix. Industry fixed effects and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	Abnormal R&D exp (1)	Abnormal exp (2)	Abnormal CFO (3)	Abnormal prod (4)
Academic board	0.005**	0.011	0.006**	-0.018**
	(2.24)	(1.28)	(2.14)	(-2.47)
PhD CEO	0.024***	0.034*	0.001	-0.024
	(3.39)	(1.76)	(0.12)	(-1.58)
Academic board×PhD CEO	-0.004	-0.007	0.015	-0.005
	(-0.42)	(-0.31)	(1.49)	(-0.23)
Size	-0.008***	-0.034***	0.003**	0.020***
	(-8.32)	(-9.47)	(2.32)	(6.35)
Ln(Age)	0.001	0.002	-0.004***	-0.002
	(1.18)	(0.40)	(-3.03)	(-0.53)
Sales growth	0.006*	-0.005	-0.009*	0.065***
	(1.72)	(-0.57)	(-1.67)	(6.84)
Ln(Tobin's Q)	0.054***	0.228***	0.067***	-0.219***
	(11.72)	(15.79)	(9.23)	(-14.58)
ROA	-0.137***	-0.363***	0.268***	-0.129***
	(-9.97)	(-8.32)	(12.66)	(-2.86)
Leverage	-0.029***	-0.102***	-0.006	0.007
	(-5.19)	(-5.01)	(-0.72)	(0.36)
Institutional ownership	-0.012**	-0.033**	0.020***	0.006
	(-2.46)	(-1.98)	(3.41)	(0.40)
Ln(CEO tenure)	0.002*	0.006	0.002	-0.000
	(1.87)	(1.28)	(1.26)	(-0.10)
Ln(CEO age)	-0.035***	-0.124***	0.008	0.041
	(-4.15)	(-4.36)	(0.79)	(1.52)
CEO ownership	-0.000	0.000	-0.000	0.001
	(-0.42)	(0.13)	(-1.37)	(1.05)
Ln(# Analyst)	0.008***	0.022***	0.011***	-0.019***
	(5.61)	(4.27)	(5.70)	(-4.03)
Industry & Year FE	Yes	Yes	Yes	Yes
N	20406	20406	20385	20054
R^2	0.238	0.239	0.295	0.199

Table 13: Firm Performance

This table reports the coefficient estimates of pooled panel regressions that examine the effect of academic director on firm value. The dependent variables are the logarithm of Tobin's Q in all models. Academic board equals one if the firm has at least one academic director in a given year, and zero otherwise. High R&D is a dummy variable equal to one if the firm's R&D is greater than the median R&D in our sample, and zero otherwise. Mature firm is a dummy variable equal to one if a firm is classified as a mature firm based on age, size, and leverage ratio. STEM equals one if a firm has at least one STEM academic director. BUS equals one if a firm has at least one academic director with a business, economics or law background. OTH equals one if a firm has at least one academic director from other fields. We control for Size, Ln(Age), Tangibility, ROA, Volatility, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, Board size, % Independence, and CEO duality. More detailed definitions of variables are reported in the Appendix. Industry fixed effects and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

Table 13: Firm Performance

	Ln(Q) (1)	Ln(Q) (2)	Ln(Q) (3)	Ln(Q) (4)
Academic board×High R&D	0.049**			
	(2.54)			
Academic board×Mature firm		0.013	0.019	
		(0.72)	(1.22)	
STEM×High R&D				0.050**
				(2.09)
BUS×High R&D				0.007
				(0.32)
OTH×High R&D				0.033
				(0.74)
Academic board	-0.003	0.018	-0.010	
	(-0.22)	(1.14)	(-0.72)	
High R&D	0.151***			0.150***
	(8.69)			(8.74)
Mature firm		-0.022**	-0.028***	
		(-2.02)	(-2.73)	
STEM				0.030*
				(1.66)
BUS				-0.014
				(-0.89)
OTH				-0.040*
				(-1.75)
R&D			2.004***	
			(19.88)	
Size	-0.030***			-0.031***
	(-6.37)			(-6.57)
Ln(Age)	-0.029***			-0.029***
	(-4.83)			(-4.74)
Tangibility	0.024	-0.006	-0.009	0.022
	(0.82)	(-0.18)	(-0.32)	(0.75)
ROA	0.886***	0.900***	1.035***	0.890***
	(14.23)	(13.78)	(19.55)	(14.47)
Volatility	-0.252***	0.004	-0.369***	-0.258***
	(-3.05)	(0.05)	(-4.65)	(-3.12)
Leverage	-0.032			-0.028
	(-0.92)			(-0.81)
Institutional ownership	-0.039*	-0.052**	-0.045**	-0.039*
	(-1.82)	(-2.38)	(-2.33)	(-1.85)
Ln(CEO tenure)	0.023***	0.028***	0.010*	0.022***
	(3.58)	(4.26)	(1.78)	(3.48)
Ln(CEO age)	-0.165***	-0.212***	-0.125***	-0.168***
	(-4.13)	(-5.00)	(-3.41)	(-4.25)
CEO ownership	0.000	0.000	0.001	0.000
	(0.06)	(0.19)	(0.65)	(0.04)
Board size	0.003	-0.009***	-0.004**	0.003
	(1.29)	(-3.97)	(-1.97)	(1.22)
% Independent	0.012	0.001	-0.026	0.016
	(0.29)	(0.04)	(-0.71)	(0.40)
CEO duality	-0.000	-0.014	0.004	0.001
	(-0.05)	(-1.55)	(0.54)	(0.08)
Industry & Year FE	Yes	Yes	Yes	Yes
N	22019	22019	22019	22019
R^2	0.297	0.256	0.350	0.301

Chapter 2

Does It Pay To Hire A Friend?

2.1 Introduction

In recent years, professional and social connections between corporate CEOs and their boards have attracted much academic attention. There is empirical evidence that corporate CEOs benefit from social connections with their boards. For instance, Hwang and Kim [63] show that board-connected CEOs receive higher pay with lower pay-performance sensitivities and face weaker termination threats. Theoretically, if CEO-board connections bring the CEO higher pay and a safer career without offering benefits to the firm, the shareholder wealth effect will be negative. However, pre-existing ties between CEOs and their boards could facilitate communication and coordination between the two vital parties of the firms and, as a result, benefit the shareholders (Rogers and Bhowmik [96], Uzzi [105], Ingram and Roberts [64]). In this paper, we study the net shareholder effect of CEO-board pre-existing connections in the context of new CEO hiring. Specifically, we ask whether it is beneficial for a board to hire a CEO with pre-existing professional ties with the board.

New CEO hiring provides an interesting empirical setting for studying the effects of CEO-board connections. In common studies of the relation between CEO-board connections and shareholder value, researchers are often challenged by potential omitted factors affecting both CEO-board connections and shareholder value. For example, firms with large boards and experienced directors tend to have both CEO-board connections and good firm performance.

Endogeneity thus makes it difficult for researchers to draw a causal inference about the effect of CEO-board connections. The issue is further complicated by the possibility that a CEO can influence director appointments and capture the board (e.g., Fracassi and Tate [46], Coles et al. [24], Khanna et al. [74]). To address these concerns, we focus on firm performance changes around new CEO hiring and utilize a difference-in-differences testing approach. Our empirical strategy mitigates the endogeneity concerns for two reasons. First, our identification relies on within-firm changes around CEO turnovers and, as such, our results are not driven by purely cross-sectional differences between firms with connected CEOs and those without. Second, the staggered nature of CEO turnovers at different firms and our concentration on the short time period around a CEO turnover help us attribute the change in firm performance around the turnover to the change of CEOs. In addition, our focus on new CEO hiring mitigates concerns about the confounding effects of CEO power and allows us to concentrate on board decision-making.

We start our analysis by investigating whether it is a prevalent board strategy to hire a CEO based on his pre-existing connections with the board. Such a test requires us to compare the unconditional probability that a candidate is chosen as CEO by a hiring firm with the probability of CEO hiring conditional on the candidate having pre-existing ties with the hiring board. Thus, we conduct this test in a dataset consisting of not only new CEOs hired by S&P1500 firms during 2000–2016, but also potential candidates for these CEO positions. The event-candidate level data is more suited for studying this question than a dataset consisting of only newly hired CEOs because the former provides less biased reference groups. For instance, a finding in a new CEOs-only dataset that more than half of new CEOs have pre-existing ties with their boards is difficult to interpret without a comparison to the proportion of CEO candidates that have such ties. Because we study pre-existing professional ties, we exclude cases in which a new CEO is internally promoted.

Internally promoted CEOs, by definition, are all connected with the hiring boards.

We consider three sets of CEO candidates for each CEO hiring event: all external CEOs hired in a given year by S&P1500 firms, all external top five executives hired in a given year by the universe of public firms, and all external top five executives hired in a given year by the universe of public firms in addition to external CEOs hired by private firms in that year. Individuals in these sets are clearly on the job market before a CEO hiring event and, therefore, are potential candidates for the CEO post.[1] In all three event-candidate level datasets, we find consistent evidence that pre-existing professional ties between a CEO candidate and the hiring board are associated with a greater likelihood that the candidate is chosen as CEO. As an example of the economic magnitude of the relation, in the candidate pool consisting of external CEOs hired by S&P1500 firms, a candidate's connection with a hiring board corresponds to a 3.75 percentage points increase in the probability the candidate is chosen by the hiring firm. This is a large effect given that the unconditional probability of CEO hiring is 2.5%.

Theoretically, a board's decision to hire a connected CEO could be driven by two distinct sets of considerations. The first set of considerations reflects the board's intention to maximize firm value. Firms and candidates do not have perfect information about each other (Jovanovic [69], Gibbons and Murphy [50]). If a candidate has connections with the hiring board prior to the search, the board can gain soft information about the candidate and infer the quality of the candidate (Montgomery [87], Yonker [112]). The candidate can also obtain information about the firm, which alleviates his concerns about the job. Therefore, connections help the firm reduce search costs and achieve a high firm-CEO match quality. A high quality firm-CEO match resulting from pre-existing board-CEO connections could also

[1] Ideally, we want to include only actual candidates considered by each hiring board. However, such data is extremely difficult to come by. For this reason, we consider three sequentially larger candidate sets. As the set gets larger, the probability of covering all actual candidates increases, although more pseudo candidates are included as well.

lead to smoother communication and coordination between the two parties after the new CEO joins the firm, compared to an unconnected CEO (e.g., Ingram and Roberts [64]). The second set of board considerations for hiring connected candidates is the board's self-interest. A board may hire a connected candidate to help a friend (Hwang and Kim [63]). Also, it takes less effort for a board to hire someone they know (Yonker [112]). Our finding that boards are more likely to choose CEO candidates that they are connected to could be the result of either set of considerations.

However, the two reasons for hiring a connected CEO have opposite predictions about the effect of connected CEO hires on firm performance. Connection-based hiring motivated by firm value maximization should have a positive effect on firm performance, while connected hiring motivated by boards' self-interest should have a negative impact on firm performance. Thus, in the second part of the paper, we compare changes in firm performance around CEO turnovers between firms hiring connected CEOs and firms hiring unconnected CEOs. We examine two aspects of firm performance: profitability (measured by return-on-assets) and market value (measured by Tobin's Q). We measure the change in firm performance over the period beginning three years before and ending two years after the hiring event. We find that, for both performance measures, firm performance increases significantly more for firms that hire connected CEOs than for firms that hire unconnected CEOs. On average, the change in return-on-assets is 1.5 percentage points higher and Tobin's Q is 3.9% higher for firms hiring connected CEOs than for firms hiring unconnected CEOs. We obtain these results after controlling for firm fixed effects and year fixed effects and, therefore, these estimates are not contaminated by purely cross-sectional variations or common time trends in the data. Our parallel trend tests also suggest that, first, there are common pre-trends in performance between firms hiring connected CEOs and firms hiring unconnected CEOs; second, the divergence in performance starts after the hiring event, as we would expect. For market value, the effect occurs immediately upon the new CEO's arrival; for accounting profitability, the effect occurs two years after the new CEO joins. Overall, our baseline results on firm performance changes suggest that it is valuable for a firm to hire a CEO with pre-existing ties to its board, consistent with the hypothesis that connected hires are motivated by firm value maximization.

We argue that the change in firm performance around CEO turnovers results from the change in CEO because it is implausible that a confounding event occurs at the same time as the CEO turnover for every firm, given the staggered nature of CEO turnovers.[2] To further attribute the performance improvement around CEO turnovers to CEO-board connections, we need to rule out other factors influencing performance changes around CEO turnovers that are also potentially correlated with CEO-board connections. Forced CEO turnover could be such a factor. Because the outgoing CEO typically under-performs before a forced turnover, the replacement is likely to result in performance improvement. If forced turnover is somehow correlated with connected hiring, it could lead to a correlation between connected hiring and performance improvement. CEO talent and CEO network centrality are two other potential confounds. Talented CEOs or CEOs with a large social network tend to improve firm performance. We would observe our results if talent or network centrality also affects a candidate's connections with the hiring board. To assess these possibilities, we control for forced CEO turnover, CEO network centrality, or CEO talent interacted with the *POST* dummy in the difference-in-differences regressions for robustness. We find that our results remain robust both statistically and economically in spite of these additional controls.

Firms hiring connected CEOs could have different characteristics from firms hiring unconnected CEOs. CEOs hired by connected boards could also differ from CEOs hired by uncon-

[2] There could be performance mean reversion around CEO turnovers. However, we check and find no correlation between pre-turnover firm performance and connected CEO hiring. Thus, our difference-in-differences methodology should control for the mean reversion of firm performance.

nected boards. We compare connected hiring firms with unconnected hiring firms but find no difference in firm size, profitability, investment, valuation, and other financial characteristics. However, connected hiring firms have less busy boards and their previous CEOs are more likely to be forced out. When we compare connected CEOs with unconnected CEOs, we find no significant difference in CEO talent, network centrality, gender, education, etc., but connected CEOs are older, more likely to be the chairman, and have more experience working in a public firm recently. To ensure the different board busyness and CEO characteristics are not omitted factors driving our results, we conduct additional robustness tests controlling for these characteristics interacted with *POST*. Our results remain statistically and economically robust. Importantly, none of these governance and CEO characteristics are significant determinants of the performance change around CEO turnovers. The results from all these robustness tests lead us to conclude that the performance effect of connected CEO hiring we find is not a manifestation of other confounds that both correlate with CEO-board connections and affect firm performance.

After establishing the main empirical finding that it benefits a firm to hire a CEO candidate with pre-existing ties with the board, we turn to investigating the channels through which connections matter. The firm value maximization hypothesis argues that firms hire CEOs with pre-existing connections to their boards to mitigate both the board's and the candidate's concerns due to information asymmetry, as well as to facilitate good firm-CEO matches and board-CEO coordination. Under this argument, the benefit from hiring a connected CEO should be particularly salient if there is large information asymmetry between the firm and the candidate. The benefit should also be significant when the candidate is worried about termination risk, in which case connections help reduce his/her concern of termination. Finally, the benefit should be large when it is difficult for the board and the CEO to coordinate. Using opacity and institutional ownership to measure information asymmetry, return volatility and R&D intensity to proxy for CEO termination risk, and board size to measure coordination costs, we find that there is a greater increase in firm performance for connected hires than unconnected hires in the subsample with higher information asymmetry, CEO termination risk, and coordination costs, but not in the subsample with lower information asymmetry, CEO termination risk and coordination costs. The effect is both statistically significant and economically larger in the former subsample. These results lend support to the idea that connected hiring benefits a firm because it helps mitigate information asymmetry, alleviate the CEO's termination concern, and facilitates CEO-board coordination.

Schmidt [102] argues that mergers and acquisitions are major corporate events that require close cooperation between directors and executives, and both the monitoring role and the advising role of the board are important for the success of a merger bid. Therefore, CEO-board connections, through the facilitation of CEO-board coordination, are likely to increase acquisition returns. Following Cai and Sevilir [19] and Schmidt [102], we collect the cumulative abnormal announcement returns around M&A announcements for bidders, and test whether connected CEOs are more likely to make value enhancing acquisitions. We find that connected CEOs are associated with higher announcement returns. We find statistically insignificant and economically small announcement return (-0.5%) on acquisitions made by unconnected CEOs. By contrast, acquisitions made by connected CEOs earn a significant positive announcement return of 2.2%. These results suggest that connected CEOs can enhance firm value by making better acquisitions and corroborate the CEO-board coordination channel of the connection effect.

We conclude our empirical analyses by examining CEO compensation. If connected hires are driven by boards rendering favors to their friends, then CEO compensation is likely to be higher for connected hires than unconnected hires. By contrast, there is no clear prediction about the relation between connected hires and compensation if boards hire connected CEOs to boost shareholder value. On the one hand, connections may enable boards to hire the most talented CEOs and such CEOs should be paid more. On the other hand, connections mitigate CEO candidates' concerns about termination risk and, as a result, the CEOs do not demand higher pay. We do not find evidence supporting the hypothesis that the boards render favors to connected CEO candidates. More specifically, we find no significant difference in the first full year's CEO total pay between connected and unconnected CEOs. The same result holds when we examine excess CEO pay, i.e., pay adjusted for firm size and industry effects. The results on CEO pay further contradict the board's self-interest hypothesis.

The main contribution of this paper is to enhance our understanding of the value effect of personal connections between a firm's CEO and its board of directors. Prior literature finds evidence that CEO-board social ties are costly to investors (Hwang and Kim [63], Fracassi and Tate [46], Coles et al. [24], Khanna et al. [74]).[3] However, the literature either focuses on ties built by the CEO through director appointments or does not differentiate such ties from pre-existing ties. By examining CEO turnovers, we control for the effects of CEO power and explicitly focus on the effects of the board's hiring decision. We discover that CEOs hired with pre-existing ties with firms' boards improve the firms' operating performance and increase firm value. Our results suggest that board-candidate connections mitigate information asymmetry and facilitate the hiring of talented CEOs. Our findings are complementary to Schmidt [102], who shows that CEO-board social ties within merger acquirers are associated with higher bidder announcement returns when the potential value of board advice is high. However, our results are particularly important because we study

[3] Hwang and Kim [63] find that connected CEOs receive higher pay with lower performance sensitivities and face lower termination threats. Fracassi and Tate [46] find that powerful CEOs are likely to appoint directors with ties to the CEOs and that such firms make value-destroying acquisitions. Coles et al. [24] show that more directors hired by the CEO are associated with lower board monitoring effectiveness. Khanna et al. [74] argue that connections CEOs develop with top executives and directors through their appointment decisions increase the risk of corporate fraud.

new CEO hiring, a critical event with long-term effects on a firm. This setting also allows us to focus on pre-existing connections established before a CEO gains power in a firm. Furthermore, results from our difference-in-differences analyses around CEO replacement are not subject to the concern that firms hiring connected CEOs are intrinsically different from firms hiring unconnected CEOs.

Our paper also contributes to the literature on the advisory roles of boards of directors and, in particular, advisory roles based on their professional and social networks. More connected boards could possess greater general knowledge as advisors, improve information flow and communications with other firms, or win business contracts using their relationships (Cai and Sevilir [19], Goldman et al. [51], Larcker et al. [81]).[4] However, boards' connections could also result in flawed decision making based on weaker critical analysis, a lowering of standards, or missed opportunities (Ishii and Xuan [65]).[5] We find that boards' professional networks help them do a vital job, i.e., identify and attract talented CEOs who are good fit with their firms.

Last but not least, this paper contributes to our understanding of boards' CEO selection decisions. Much of the literature has searched for models of good matching quality between a firm and its CEO (e.g. Rosen [97], Sattinger [101], Gabaix and Landier [49], Terviö [104], Pan [91], Cziráki and Jenter [30], Wang [106]).[6] We identify board-candidate connections as an important hiring criterion as such connections significantly improve the information flow

[4] Cai and Sevilir [19] find that acquirers whose boards are connected with their target boards receive higher announcement returns. Larcker et al. [81] show that firms with well-connected boards outperform. Goldman et al. [51] provide evidence that politically-connected boards help their firms win government contracts.

[5] Ishii and Xuan [65] find that cross-firm social connections between directors and senior executives at the acquiring and the target firms reduce announcement returns to the acquirer and the combined entity while increasing the acquirer CEO's pay and improving the target CEO and directors' job retention.

[6] In the matching framework, firm and employee attributes are complementary to each other (Rosen [97], Sattinger [101]). Gabaix and Landier [49] and Terviö [104] develop an equilibrium model based on the complementarity between CEO talent and firm size. Extending their work to a multidimensional setting, Pan [91] develop a matching model based on complementarities between firm size and CEO talent, firm diversification and CEO conglomerate experience, and firm innovation and CEO technical expertise.

between a hiring board and its new CEO. We further show that the improved information transmission and CEO-board cooperation will benefit the firms by improving accounting and stock market performance. As such, we also contribute to the literature that studies the impact of CEO hiring decisions (e.g., Parrino and Srinivasan [93], Kaplan et al. [72], Custódio and Metzger [29]).

Our paper is related to Cziráki and Jenter [30]. Cziráki and Jenter [30] show that 90% of new CEOs are executives firms are familiar with. They are either insiders or former colleagues of the hiring firm's directors. However, they do not compare personal connections with other determinants of CEO hiring decisions, nor do they study the consequences of the connection-based hiring strategy. Wang [106] studies the determinants of CEO selection and conducts some auxiliary analysis on post-succession operating firm performance. Different from Cziráki and Jenter [30] and Wang [106], our paper aims at identifying the net benefit of connection-based CEO hiring. We examine both operating and stock performance in a difference-in-differences framework that controls for purely cross-firm variations and common time trends; we control for alternative channels through which performance changes may differ between connected and unconnected hires; and we find subsample results in support of our information and coordination hypothesis.

2.2 Literature Review and Hypothesis Development

Social connections are important to CEO labor market outcomes. In a perfect labor market, candidates and job positions are matched when marginal benefits equate marginal costs. However, as argued by Granovetter [54] and Alan [6], social networks are crucial in real world labor markets as imperfections (e.g., information asymmetry, costly searching, etc..) exist. Such imperfections are present in executive labor markets. For example, Liu [83] argues that information on both job opportunities and potential candidates is hard to obtain and hence market participants largely rely on the networks of directors and executives to find potential matches. Yonker [112] also suggests that information asymmetry and searching costs are important concerns to CEO-firm matches and lead to firms biasing toward local candidates.[7] This leads to our first testable hypothesis:

Hypothesis 1 (H1)**.** *Firms are more likely to hire a CEO candidate that has pre-existing connections to the board of directors.*

A board's decision to hire a connected CEO can stem from value maximization considerations. Under market imperfection, if a candidate is connected with board members of the hiring company, the board can gain soft information on the candidate, and the candidate can learn more about the current situation of the hiring company, the strategic plan of the company, his upcoming duty, and the expected outcomes (Montgomery [87], Yonker [112]). As a result, connections reduce search costs and improve CEO-firm match quality. Pre-existing connections also result in smooth communication and coordination between the directors and the CEO, and such improvement is valuable to firms. In Adams et al. [2]'s model, a board can execute its advising role better when executives are more willing to communicate private information with the board. A similar argument is presented in Harris and Raviv [59]. Empirically, Ingram and Roberts [64] find that board interlocks[8] improve information flow. Duchin et al. [35] find that when the cost of acquiring information is low, performance increases when outsiders are added to the board, and when the cost of information is high, performance worsens when outsiders are added to the board. Furthermore, Schmidt [102] show that the a friendly board is associated higher M&A announcement returns, especially

[7] More work related to imperfections of the CEO labor market include Jovanovic [69] and Gibbons and Murphy [50].

[8] Board interlocks refer to the cases in which two CEOs are members of the boards of directors of each other's companies.

when cooporation between the CEO and board is appreciated.[9]

A second set of considerations for selecting a connected CEO is a board's self-interest. Such decisions may hurt firm value. For example, Hallock [57] shows that CEOs sitting on each other's boards receive more compensation. Hwang and Kim [63] find that CEOs that are connected to the company board receive higher compensation, achieve lower pay-performance sensitivity, and exhibit lower turnover-performance sensitivity. Fracassi and Tate [46] show that CEOs connected to boards destroy firm value and are envolved in more value-destroying acquisition deals. Kramarz and Thesmar [78], using French data, confirm that connected CEOs are paid more, are less likely to be replaced when the firm under-performs, and are less likely to engage in value-creating acquisitions.[10]

These two sets of contradicting arguments and evidence lead to our firm value maximization hypotheses:

Hypothesis 2 (H2)**.** *Firms hiring connected CEOs have stronger performance improvement than firms hiring unconnected CEOs.*

Hypothesis 3 (H3)**.** *Firms hiring connected CEOs make more value enhancing acquisitions.*

The firm value maximization hypothesis states that firms hire CEOs with pre-existing connections to their boards to mitigate the concerns of both the boards and the candidates due to information asymmetry, as well as to facilitate good firm-CEO matches and board-CEO

[9]In other fields, smooth information flow facilitated by networks is shown to be availing. See, for example, Hochberg et al. [62], Cohen et al. [21] and Cohen et al. [22]. Hochberg et al. [62] find that better-networked venture capital firms experience significantly better fund performance because networks promote the sharing of information and resources among venture capital firms. Cohen et al. [21] find that portfolio managers perform significantly better on their connected holdings because networks facilitate information transfer from senior firm officers to portfolio managers. Cohen et al. [22] find that analysts perform significantly better on their stock recommendations when they are connected to the company because networks facilitate the transmission of information from corporate board members to sell-side analysts.

[10]More arguments and evidence on board independence improves firm performance include but is not limited to Jensen and Meckling [67], Fama and Jensen [43], Weisbach [107], Jensen [66], Brickley et al. [16], Cotter et al. [25], Mayers et al. [86], Larcker et al. [80], Paul [94], Nguyen [89], Ishii and Xuan [65] and Khanna et al. [74].

coordination. Hence, when there is strong information asymmetry between the hiring firm and candidate, the benefit from hiring a connected CEO is greater. The benefit is also greater when the candidate is more worried about the risk of termination, in which case connections can help reduce such concerns. Additionally, the benefit should be larger when it is more difficult for the board and the CEO to coordinate, and pre-existing connections can smooth communication and enhance cooperation between the CEO and the board. These arguments lead to our forth hypothesis:

Hypothesis 4 (H4)**.** *Stronger performance improvement is concentrated in firms with higher information asymmetry, greater CEO termination risk, and larger coordination costs.*

Last but not least, we investigate how connected CEOs are compensated. If a board hires a connected CEO for personal interest, the CEO is likely to be paid more (e.g., Hallock [57], Hwang and Kim [63]). By contrast, there is no clear prediction about the relation between connected hires and compensation if boards hire connected CEOs to boost shareholder value. Connections may enable boards to hire the most talented CEOs and such CEOs should be paid more (e.g., Cremers and Grinstein [27], Gabaix and Landier [49], Albuquerque et al. [7], Jung and Subramanian [70]). Alternatively, CEO candidates risk their reputations and careers by joining unfamiliar companies, and hence requires a premium in their compensation package (Gibbons and Murphy [50], Peters and Wagner [95]). If connections can mitigate the uncertainty of matching and assist information flow between candidates and firms, then connected CEOs will demand lower pay than unconnected CEOs. Hence, we would like to test our final hypothesis:

Hypothesis 5 (H5)**.** *Connected CEOs receive higher total compensation and higher abnormal compensation.*

2.3 Data and Sample

2.3.1 Data Sources

We use multiple data sources for our empirical analyses. We collect the name and pay information of CEOs from the Execucomp database. The CEO names are used to define CEO turnover events (see more detail in Section 2.3.2). We use BoardEx to obtain board information, director characteristics, and CEO/candidate characteristics. BoardEx records individual profiles such as education background and employment histories. Information about individual network (e.g., overlapping organizations, overlapping starting year and ending year, roles of individuals at overlapping firms) are also from Boardex. To identify internal promotions and external hires, we use a combination of CEO replacement data from Eisfeldt and Kuhnen [36], BoardEx employment history file, and Factiva data. Company financial information and stock return data are from Compustat and CRSP.

2.3.2 CEO Appointments

To construct the sample of CEO appointments, we begin by identifying all new CEO appointments by S&P 1500 firms from 2000 to 2016. Prior to 2000, BoardEx's coverage of public firms is limited. Following Eisfeldt and Kuhnen [36], we identify a new CEO appointment by observing change in the name of the individual who has the CEO title (when the CEOANN variable from Execucomp equals "CEO") in two consecutive years. A total of 3,612 CEO appointments are identified. We exclude 375 appointments of interim CEOs and 220 appointments for which we cannot find information about the firm or the CEO in BoardEx. Following Cremers and Grinstein [26], we define interim CEOs as those who have been employed at the firm for one year or less.

We then exclude 1,828 internal promotions. We define internally promoted CEOs as individuals who have been employed at the firm for more than one year before the CEO appointment, following Parrino [92].[11] We focus on external CEO appointments because all internal candidates are, by definition, connected to the board of directors. There should be relatively little information asymmetry and low coordination costs between a board and an internally promoted CEO. Also, internal promotion events tend to involve mostly internal candidates. Prior literature suggests that firms with specific characteristics are more likely to select CEOs from internal candidates (e.g., Datta and Guthrie [32], Naveen [88], Cziráki and Jenter [30]). As noted by Harrell [58], an internal promotion takes years to prepare and costs less than external hirings. As a result, firms promoting internal candidates will likely not consider external candidates and the internal promotion process is very different from the external hiring process. The fact that all internal candidates are connected can thus induce two potential biases for our analysis. First, including internal promotions would lead to an upward bias in the estimated importance of connections in the CEO hiring decision. Second, excluding internally promoted CEOs also helps us compare performance changes around CEO turnovers between connected and unconnected CEOs without the confounding effects of any differences between internally promoting firms and externally hiring firms. This is because, if the decision between an internal and an external search is performance related, including internal promotions could bias our conclusions about the effect of connections on performance.

From the 1,189 external CEO appointments, we remove 124 appointments associated with mergers and acquisitions and 137 appointments with missing board characteristics. We require firms to have financial and stock return data in Compustat and CRSP for the three years prior to new CEO appointments, which reduces our sample by 47 appointments. We

[11] Under this definition, an individual who is hired as a senior executive (e.g., COO) and then promoted to CEO within a year is considered an external hire. Our results are robust to excluding such cases.

also require firms to have data in Compustat and CRSP for the two years after new CEO appointments, which further reduces the sample by 85 appointments.[12] Finally, we remove 122 appointments in which the new CEO does not stay for more than two fiscal years. Our final sample consists of 674 external CEO appointments.

One might worry about a selection/survival bias because we require a new CEO to stay with the firm for at least two years. This restriction can bias our results when connected CEOs are more likely than unconnected CEOs to be fired for bad performance in the first two years. To alleviate this concern, we compare the propensity of performance-related turnover between connected and unconnected CEOs among the 122 dropped appointments. We find that out of 26 connected CEOs who leave in the first two years, 7 are fired for performance reasons (26.9%). By contrast, out of 93 unconnected CEOs who leave in the first two years, 43 of them are forced out (46.2%).[13] These statistics suggest that connected CEOs are less likely than unconnected CEOs to be fired for poor performance in the first two years. Hence, excluding CEOs that depart in less than two years should make it harder for us to find a positive relation between connections and post-turnover performance increase.

2.3.3 CEO/Candidate-Board Connections

We create an indicator variable to capture the connections between CEOs/candidates and the hiring firm's board. The indicator variable, CONNECT, equals one if a CEO/candidate shared employment experience with at least one board member of the hiring firm, and zero otherwise. There are many types of shared experiences (e.g., education, clubs, societies, non-

[12] Nevertheless, 10% attrition rate is typical when compared with the sample attrition rate in the CRSP-Compustat universe and the S&P 1500 subset. In untabulated results, we find that in an average fiscal year between 1993 and 2018, after applying standard sample filters in the literature, more than 17% of the CRSP-Compustat firms drop out of the sample in the next two years. The attrition rate is 11% for S&P 1500 firms.

[13] We cannot find the reasons of turnover for three of the dropped appointments.

profit organizations) but we consider only shared employment experiences in public firms and private firms. This is because shared experiences through other channels are not common in our context.[14] The connected parties must both be managers or both be directors at overlapping firms (Khanna et al. [74], Cziráki and Jenter [30]). There is one exception, one party is a CEO and the other party is a director. The reason we do not consider director-non-CEO manager connections is that board members usually do not interact with non-CEO managers. We exclude connections established within the hiring firms.[15] Among the 674 turnover events in our sample, 190 new CEOs have pre-existing connections with the hiring firm's board (28.2%). The fraction of connected new CEOs is comparable to that in Khanna et al. [74] and Cziráki and Jenter [30].

2.3.4 Potential CEO Candidates

To empirically test a board's preference for connected candidates, we must obtain the pool of potential candidates considered by each hiring firm. Unfortunately, the "true" candidate pools are un-observable to researchers.[16] Hence, we include in our candidate pool individuals that change jobs during the year of a CEO turnover event. Such individuals are in the job market that year and therefore, are more likely to be considered by the hiring firm for the open CEO position. Initially, we consider all the newly hired CEOs in a given year in our CEO turnover sample as potential candidates for each of the hiring firms in that year. This is the smallest candidate pool.

[14] Among new CEOs who do not share employment experiences with the hiring firm's board, only 6 of them share experiences with the board through education and 11 of them share experiences with the board through other channels. Our results are robust to including all types of shared experiences.

[15] There is one exception, an independent director on the hiring firm's board is appointed CEO. This independent director is an outsider but he is also on the hiring firm's board, so he is "connected" to other directors on the board.

[16] Exceptions are Kaplan et al. [72] and Kaplan and Sorensen [73] who use data provided by a consulting firm that assesses job candidates for hiring firms.

This candidate pool is potentially inaccurate for two reasons. First, a hiring firm probably considers candidates beyond the new CEOs hired by our sample firms this year. This measurement error could lead to a biased estimate of the importance of connections in the CEO hiring decision, although the direction of such bias is unclear. In an effort to capture as many actual candidates as possible, we construct two alternative candidate pools by including additional potential candidates. The first alternative candidate pool for each hiring event consists of all the newly hired CEOs and top executives of all public firms. Thus, this candidate pool encompasses the initial pool but additionally considers new top executives in S&P1500 firms and new hires in non S&P1500 public firms. We also construct a second alternative candidate pool that includes all newly hired CEOs and top executives from all public firms, as well as all newly hired CEOs from private firms. We will refer to the resulting hiring event-candidate sample based on the initial candidate pool as the "small sample", and the samples based on the two alternative candidate pools as the "medium sample" and the "large sample", respectively. As we move from the small sample to the large sample, the candidate pool is moving closer to the universe of talent supply and, therefore, it becomes more likely for us to capture all actual candidates considered by the hiring firms.

The second potential problem is that our pools include individuals that are not considered by the hiring firms (pseudo candidates). The larger the candidate pool we consider, the more pseudo candidates there are. However, we argue that, because the CEO hiring decision is essentially the combination of two decisions: (1) identifying candidates from the universe of talent supply and then (2) selecting the one best fitting the firm, the strategy of considering the universe of talent supply is economically meaningful. In other words, we believe that it remains interesting to examine the effect of connections on the probability of CEO hiring in the universe of talent supply.

Table 1 summarizes the three hiring event-candidate samples. Panel A of Table 1 summarizes the characteristics of the small sample. Out of more than 27,000 event-candidate observations, about 2.5% are hired as CEOs and 18.8% of the candidates have pre-existing connections with the hiring board. As of the year before the hiring year, an average candidate is 52 years old. The majority of the candidates (95.7%) are male and most of them have been a CEO (73.4%) or other executive (40.9%). 70.8% have worked at a publicly traded company and an average candidate has worked for approximately two firms. Panel B and C present summary statistics for the medium and large set. The sample sizes differ vastly. Nevertheless, we observe very similar characteristics across each sample, despite the extreme variation in sample sizes.

2.4 Connections and CEO Hiring Decisions

In this section, we study the role of candidate-director connections on a board's decision to hire a CEO. We focus on the event-candidate samples and specify a Logit model to test our hypothesis. The dependent variable, HIRED, is a dummy variable which equals one if a CEO candidate is hired by a firm in a given year and zero otherwise. The key independent variable is the connect dummy (CONNECT) indicating whether a candidate is connected to at least one director of each hiring firm prior to the year of hiring. We also control for candidate's age, gender, education background, and work experience (i.e., previous positions, public firm experience, and the number of employers). We include firm and year fixed effects to control for unobserved heterogeneity. Standard errors are clustered at firm level.

The regression results are reported in Table 2. Column (1) presents the result of the Logit model with all newly hired CEOs in our sample as potential candidates (small sample). We only control for year and firm fixed effects and do not include proxies for firm or candidate characteristics.[17] The estimated coefficient on the connect dummy is positive and statistically significant, indicating that pre-existing connections significantly increase a candidate's probability of being hired as a CEO. The impact is also economically meaningful. Connected candidates are 3.75% more likely to be hired than unconnected candidates. Compared with the unconditional probability (2.46%) of being hired, this effect is large and equals to a 152% increase (i.e., 3.75/2.46).

Columns (2) and (3) report regression results with the medium and large samples, respectively. After controlling for the firm and candidate characteristics, the connect dummy still has a statistically and economically significant impact on boards' CEO selection decisions. Connected candidates are 0.09% (0.03%) more likely the be selected as CEOs in the medium (large) sample, while the unconditional probability in this sample is only 0.034% (0.012%).

In addition to the significance of connection to hiring decisions, the results in Table 2 also show that older male candidates with MBA degrees are more likely to be selected as CEOs. Firms also prefer candidates with CEO experience and work experience in publicly traded companies.[18] Lastly, frequent job changes decrease the candidate's likelihood of being hired by the firm.

2.5 Firm Performance

In this section, we investigate the impact of connected CEOs on firm performance. In Section 2.5.1, we conduct a univariate comparison of the characteristics of firms appointing connected CEOs and firms appointing unconnected CEOs, as well as a comparison between the characteristics of connected CEOs and unconnected CEOs, to demonstrate is there is

[17] The results are minimally affected when we include additional controls.

[18] Similarly, Cziráki and Jenter [30] show that there is a substantial demand for CEO experience among hiring firms.

any *ex ante* differences between the two groups. In Section 2.5.2, we present the results of a difference-in-differences model where firm performance measures are the dependent variables. In Section 2.5.4, we present subsample results to shed light on the channels through which connected CEOs could impact firm performance.

2.5.1 Comparison Between Firms Hiring Connected and Unconnected CEOs

We examine whether there are significant differences between firms hiring connected CEOs and firms hiring unconnected CEOs by comparing their characteristics at the end of the fiscal year prior to the CEO turnover events in Table 3. The first three columns present the number of observations, means of characteristics, and standard deviations of characteristics for firms hiring unconnected CEOs. The next three columns present the same statistics for firms hiring connected CEOs. We report the differences between the means of the two groups and the standard errors of the differences in the last two columns. A t-test of the differences in means are conducted.

We find that the two groups are similar in size as measured by the logarithm of book value of assets and the number of business segments. Firms hiring connected CEOs have similar profitability (ROA). They have similar R&D expenses, capital expenditures and growth prospects (sales growth and Tobin's Q). They are also alike in their use of debt (leverage ratio), payout (dividend and repurchase), and riskiness (stock return volatility). The two groups of firms have similar board size and fraction of independent directors. Firms hiring connected CEOs have smaller fraction of busy directors than firms hiring connected CEOs. Firms hiring connected CEOs are significantly more likely to fire the previous CEO. 35.3% of connected CEO hires occur after forced turnovers, whereas only 26.7% of unconnected CEO hires occur after forced turnovers. Overall, we do not find significant differences in firm fundamentals but some significant differences in corporate governance attributes between the two groups.

We also compare the characteristics of the newly appointed CEOs prior the year of hiring. CEO TALENT is the age at which the new CEO began his first CEO position. We don't find a significant difference in talent between the connected and unconnected CEOs. They also have similar number of connections. The connected CEOs are on average 2.25 years older. The difference is statistically significant but economically small. They are equally likely to be a male and have an MBA degree. They are also equally likely to have experience in a CEO position before. The connected CEOs are less likely to have some other executive experience, but more likely to have worked as a board's chairman or have worked for a public company. Both groups have also worked for the same number of firms before the year of hiring. We note these differences in corporate governance and CEO characteristics between connected and unconnected hiring events and will control for them in the upcoming firm performance analysis for robust inferences.

2.5.2 Connected Hiring and Firm Performance

In this section we analyze how firm performance changes around CEO turnovers, focusing a relatively short period around the turnover events and utilizing a difference-in-differences model. More specifically, we construct a sample composed of each firm's characteristics and performance measures three years before and two years after the new appointment of each CEO.[19] We then estimate the following model.

$$Y_{i,t} = \beta \times \text{CONNECT}_i \times \text{POST}_{i,t} + \gamma \times \text{POST}_{i,t} + \psi' X_{i,t-1} + \lambda_i + \alpha_t + \varepsilon_{i,t} \tag{2.1}$$

[19]The summary statistics of this sample are presented in the appendix.

where i indexes firm and t indexes time. The dependent variable $Y_{i,t}$ is the performance measure of interest, including ROA and Tobin's Q. CONNECT_i represents the treatment dummy, which equals one for firms that hire connected CEOs and zero otherwise, and $\text{POST}_{i,t}$ represents the time dummy, which equals one in the year that the CEO is hired and the two subsequent years, and zero otherwise. $X_{i,t-1}$ includes lagged firm and board characteristics such as size, capital expenditures, R&D, dividend, stock return volatility, board size, fraction of independent directors and fraction of busy directors. We also include firm fixed effects (λ_i) and year fixed effects (α_i) to control for time-invariant cross sectional variations and common time trends.

This empirical strategy mitigates the endogeneity concerns for three reasons. Firm fixed effects allow us to interpret our results as within-firm variations around CEO turnovers and hence, our results are not driven by purely cross-sectional differences between firms with connected CEOs and those without. Second, the staggered nature of CEO turnovers at different firms and our concentration on the short time period around a CEO turnover help us attribute the change in firm performance around the turnover to the new CEO's influence. Finally, our focus on new CEO hiring mitigates concerns about the confounding effects of CEO power and concentrates on board decision-making.

The OLS estimates of Eq (2.1) are reported in Table 4 Panel A. In Column (1), the dependent variable is ROA, calculated as income before extraordinary items (IB) divided by beginning period total assets (AT_{t-1}). We find a positive and significant coefficient on $\text{CONNECT}_i \times \text{POST}_{i,t}$. Relative to firms hiring unconnected CEOs, firms hiring connected CEOs improve their ROA by an additional 1.5 percentage points. This effect is economically meaningful compared with the mean (2%) and median (3.4%) ROA of the sample. The dependent variable in Column (2) is the logarithm of Tobin's Q. The coefficient on the interaction is also positive and statistically significant. The improvement in Tobin's Q after the new CEO joins the firm is 4% [= $(e^{0.039} - 1) \times 100\%$] higher for firms hiring connected CEOs than firms hiring unconnected CEOs. Overall, these results suggest that connected hiring has a positive impact on firm performance and support the value-maximizing hypothesis.

In Pane B, we examine how performance of connected CEOs and unconnected CEOs differ over time. We estimate a similar model to Eq (2.1) replacing $\text{POST}_{i,t}$ with $\text{Dum}_{i,t,y}$, where $y \in \{-2, -1, 0, 1, 2\}$. $\text{Dum}_{i,t,y}$ are indicator variables which equal one if an observation is in year y relative to the year of CEO appointment.

$$Y_{i,t} = \sum_{y=-2}^{2} \beta_y \times \text{CONNECT}_i \times \text{Dum}_{i,t,y} + \sum_{y=-2}^{2} \gamma_y \times \text{Dum}_{i,t,y} + \psi' X_{i,t-1} + \lambda_i + \alpha_t + \varepsilon_{i,t}$$

The dependent variable of Column (1) is ROA. The insignificant coefficients on CONNECT$\times$ Dum_{-2} and CONNECT $\times$ Dum_{-1} indicate that the firms hiring connected CEOs and firms hiring unconnected CEOs are indifferent in ROA in both years prior the year of CEO turnover, and hence confirming parallel pre-event trends. The coefficients on CONNECT $\times$ Dum_0 and CONNECT $\times$ Dum_1 are insignificant and the coefficient on CONNECT $\times$ Dum_2 is positive and significant. The results indicate that the improvement in accounting performance associated with connected CEOs tend to occur later. Such timing is foreseeable as accounting performance is usually results of other firm policies and reacts slower.

Column (2) reports results with LN(Q) as the dependent variable. Similarly, we find insignificant results on CONNECT $\times$ Dum_{-2} and CONNECT $\times$ Dum_{-1}, which validate the parallel trend assumption. The coefficient on CONNECT $\times$ Dum_0 is significant at 10% level and the coefficients on CONNECT $\times$ Dum_1 and CONNECT $\times$ Dum_2 are significant at 5% level. The improvement in LN(Q) is recognized earlier as the market instantaneously reacts to the news of CEO appoints.

2.5.3 Robustness Tests

The observed difference in performance improvement between the two groups of firms could be a confounding effect of forced turnovers. Firms experiencing poor performance tend to force out CEOs and display better subsequent performance. The positive correlation between forced CEO turnover and connected hiring presented in Table 3 means that it is important to consider forced CEO turnovers in our empirical models. To alleviate this concern, we repeat the analyses in Table 4, controlling for the interaction between the forced and post dummy (FORCED × $POST$). The forced dummy equals one for forced turnovers and zero otherwise.[20] The results are reported in Columns (1) and (2) Table 5 Panel A. The dependent variables are ROA and LN(Q), respectively. We still find a positive and significant coefficient on CONNECT × POST. The magnitude of the estimated coefficient is similar to what is reported in Table 4. Similarly, we find robust results in Column (2) where LN(Q) is the dependent variable. Overall, our results are robust to types of turnovers.

Columns (3) and (4) report results of the same models while controlling for the total number of connections a CEO has. If a CEO is well connected to other professional managers and directors, he/she can better improve firm performance through enhanced information sharing or lower cost of capital (e.g., Hochberg et al. [62], Engelberg et al. [38], Fracassi and Tate [46], El-Khatib et al. [37], Abernethy et al. [1]). To isolate our findings from CEO network effect and emphasize the importance of CEO-board connection, we include # CONNECTIONS and # CONNECTIONS × POST in our model. We see robust results on CONNECTIONS × POST and the coefficients are barely affected.

We then control for talent of CEO and present results in Columns (5) and (6). The observed difference between connected and unconnected CEOs can be a result of the difference between their talent. A well connected board are more likely to know more about CEO candidates and

[20] Forced CEO turnover data are from Peters and Wagner [95] and Jenter and Kanaan [68].

make better hiring decisions by acquiring more talented CEOs. Our results on CONNECT $\times$ POST remain robust in Columns (5) and (6). Lastly, we control for all the aforementioned variables in one model and present the results in Columns (7) and (8). Our results are robust when we control for all the variables that can potentially overshadow the effect of CEO-board connections.

In Panel B of 5, we explore additional robustness tests. In Table 3, we show that firms hiring connected CEOs have less busy directors and hire older candidates who are less likely to have other executive experiences, more likely to have board chairman experiences and more likely to have worked for a public company. Following the same format as in Panel A, we report results controlling for these variables one each time in Columns (1) - (10), and we include all the additional controls in Columns (11) and (12). We find that the estimated coefficients on CONNECT $\times$ POST is robust for both ROA and LN(Q) across all the models. Overall, our results presented in this section shows that the effect of connected CEOs on firm performance is robust to a series of extra controls.

2.5.4 Connected Hiring and Firm Performance, Subsample Evidence

The firm value maximization hypothesis suggests that the benefit from hiring a board-connected CEO should be concentrated in firms with greater information asymmetry, higher CEO termination risk, and larger coordination costs. In this section, we test these predictions. We form subsamples split on information asymmetry, CEO termination risk, or coordination costs, re-estimate the model in Eq.(2.1) in each of the subsample, and compare the coefficients on the interaction term $Connect \times Post$ between each pair of subsamples. The results are reported in Table 6.

Columns (1) - (2) of Panel A show the effects of connected CEO hires on the change in ROA and Tobin's Q around CEO turnovers, respectively, for firms with greater information asymmetry measures. Columns (3) - (4) present the effects of connected hiring on the change in the same performance measures around CEO turnovers for firms with less information asymmetry. In section (a) of Panel A, we use accrual opacity to proxy for information asymmetry (e.g., Billett and Yu [13], Xu and Yang [111]) and split the sample according to the median value of accrual opacity at the end of the fiscal year before CEO turnover.[21] We find that the effects of connected hiring on performance improvement following CEO turnovers is concentrated in the firms with high information asymmetry. In particular, the effects of hiring connected CEOs on the change in ROA and LN(Q) are statistically significant in the above median opacity subsample. However, they are statistically insignificant and economically small in magnitude in the below median opacity subsample. In section (b) of Panel A, we use institutional ownership to measure information asymmetry (e.g., Boehme et al. [15]). Lower institutional ownership indicates higher information asymmetry. The results are consistent with what we observe in section (a). The improvement in performance is concentrated in the firms with low institutional ownership. Our results are consistent with an information asymmetry mitigation channel of connected CEO hiring: pre-existing connections help the board attract talented CEO candidates particularly when information asymmetry is high.

In Panel B, we split the sample according to the median of measures of termination risk. We consider two proxies for high termination risk: high stock return volatility and high R&D intensity (e.g., Bushman et al. [18]). We find that there is a significant improvement in firm

[21] To calculate opacity, we run five industry-year regressions for each FF-49 industry and year t-4 to year t. The dependent variable is total accruals. Independent variables are lagged, contemporaneous, and forward cash flows from operations, change in sales, and property, plant, and equipment. Opacity is the standard deviation of the residuals from the five industry-year regressions. A detailed definition is presented in the Appendix. A larger value implies higher information asymmetry.

performance associated with connected CEO hiring in the high termination risk subsamples. By contrast, such effects are not observed in the low termination risk subsamples. The results suggest that the benefits of hiring a connected CEO are concentrated in firms with high CEO termination risk, which lends support to a termination risk reduction channel of connected CEO hiring.

Lastly, in Panel C, we create subsamples based on a proxy for coordination costs. It is usually more complicated for executives and board members to cooperate when there are more board members (Jensen [66]). When we split our sample by the median of board size, we find statistically significant performance improvement in performance among firms with larger boards. Such effects are not observed in the subsample with smaller boards. The results are in harmony with a coordination cost reduction channel of connected CEO hiring: hiring a connected CEO is particularly beneficial when coordination costs are high.

Admittedly, the difference in the coefficient estimates on the interaction term $Connect \times Post$ between the two subsamples is only statistically significant in two of the 10 cases. However, we note that the coefficients in the high asymmetry/risk/cost subsamples are always economically much greater than those in the low asymmetry/risk/cost subsamples. In fact, the high subsample coefficient is two to 11 times the magnitude of the corresponding low subsample coefficient in nine out of the 10 cases. Overall, our results indicate that the benefit from hiring a board-connected CEO is concentrated in firms with greater information asymmetry, higher termination risk, and higher coordination costs. Such results are consistent with the notion that firms hire CEOs with pre-existing connections to their boards to mitigate the concerns of both the boards and the candidates due to information asymmetry, as well as to facilitate good firm-CEO matches and board-CEO coordination.

2.5.5 Connected Hiring and M&A

Up to this point, our results are consistent with the notion that connected CEO hires are valuable to shareholders when coordination between managers and directors is important. In this section, we investigate whether hiring a connected CEO impacts the firm's merger and acquisition (M&A) outcomes. This is motivated by the notion that mergers and acquisitions are major, complex corporate events that require the board's approval, and coordination between managers and directors is plausibly beneficial (Schmidt [102]).

We collect all M&A announcements with a US public target made by the CEOs in our sample. We drop the deals smaller than $5 million. We focus on domestic acquisitions because cross-border mergers are motivated by many considerations some of which unrelated to value maximization such as economic condition of target country (Erel et al. [39]), geographic proximity (Erel et al. [39]), corporate governance (Rossi and Volpin [98]), culture (Xu [110]), market development (Boateng et al. [14]), investor protection (Bris and Cabolis [17]), and corporate social responsibilities (Li et al. [82]). We also exclude acquisitions of private target firms because these acquisitions are shown to be better acquisitions and likely be in less need of board advising and monitoring (e.g., Chang [20], Fuller et al. [48], Faccio et al. [40]).[22]

We calculate the acquirers' 5-day ($[-2, 2]$) cumulative abnormal returns around the announcement date following Cai and Sevilir [19]. The cumulative abnormal returns are calculated relative to the market model estimated using the return data of 200 trading days ending two months before the announcement date. In Panel A of Table 7 we summarize and compare the cumulative abnormal announcement returns of M&A deals made by connected CEOs and unconnected CEOs. In our sample, 77 (26.3%) announcements are made by connected CEOs, and 216 (73.7%) are made by unconnected CEOs. The mean (median)

[22] We check private target acquisitions and find an insignificant difference in the bidder's announcement return between acquisitions made by connected and unconnected CEOs.

abnormal returns is 2.2% (1.4%) for deals made by connected CEOs, and -0.5% (0.3%) by unconnected CEOs. A t-test between the means indicate that connected CEOs make M&A deals with cumulative abnormal announcement returns statistically significantly higher than unconnected CEOs.

We then estimate a panel model

$$CAR_{i,t} = \beta \times \text{CONNECT}_i + \psi' X_{i,t-1} + \gamma_j + \alpha_t + \varepsilon_{i,t} \tag{2.2}$$

where i indexes M&A deals, j indexes the industry of each acquirer (2-digit SIC) and t indexes time (calendar year). The dependent variable CAR represents the cumulative abnormal return of each announced M&A deal in our sample. The independent variable of interest CONNECT_i is a dummy variable which takes value of one if an M&A deal is made during the tenure of a connected CEO and zero otherwise. $X_{i,t-1}$ is a matrix for control variables that plausibly relate to M&A announcement returns. Following Cai and Sevilir [19], we include stock deal dummy, diversifying acquisition dummy, relative deal size, tender offer dummy, hostile take over dummy, toehold, size of acquirer, Tobin's Q of acquirer and target, leverage ratio of acquirer and target, operating cash flow of acquirer and target, stock return run-up of acquirer and target, board size of acquirer, board independence of acquirer, and board busyness of acquirer. We also include talent of CEO and total number of connections in $X_{i,t-1}$. A detailed definition of these variables is provided in the Appendix. γ_j represents industry fixed effects, and α_t represents calendar year fixed effects. All standard errors are clustered at 2-digit SIC level. The results are presented in Table 7 Panel B.

The results presented in Column (1) includes only industry and year fixed effects as controls. The estimated coefficient on CONNECT is positive and significant. Acquisitions made by firms with connected CEOs exhibit superior performance relative to the acquisitions made by firms with unconnected CEOs. The difference is also economically meaningful. CARs for mergers and acquisitions made by firms with connected CEOs are, on average, 2.2% larger than the CARs accrued to firms without connected CEOs. In Column (2), we include deal characteristics as additional controls. The estimated coefficient on CONNECT is also positive and significant. We include acquirer characteristics in Column (3) and target characteristics in Column (4) as additional controls. The results remain robust. Overall, our evidence supports the hypothesis that connected CEOs are associated with higher M&A announcement returns.

2.6 CEO Compensation

In this section, we examine the effects of connections with directors on CEO pay. We specify a similar panel model to model (2.2). More specifically, we estimate

$$Y_{i,t} = \beta \times \text{CONNECT}_i + \psi' X_{i,t-1} + \gamma_j + \alpha_t + \varepsilon_{i,t} \tag{2.3}$$

The dependent variable is CEO's total pay or excess pay. Total pay is simply the TDC1 variable reported in ExecuComp. Excess pay is the residual from a regression of the CEO's total compensation on firm size, industry fixed effects, and the interaction between firm size and industry fixed effects. The independent variable of interest is the connect dummy, $\text{CONNECT}_{i,t}$. It indicates whether a CEO is connected to the board. $X_{i,t-1}$ represents controls for firm and board characteristics, including firm size, ROA, past stock returns, Tobin's Q, capital expenditures, R&D, dividend payment, stock return volatility, board size, board independence, and board busyness. Detailed definitions of the proxies are listed in the Appendix. γ_j and α_t represent industry and year fixed effects, respectively.

To estimate this model, we focus on the sample that consists of the first full year of the newly appointed CEOs.[23] Table 8 reports the regression results. The dependent variable in Column (1) is total pay. The insignificant coefficient on the connect dummy suggests that there is no significant difference between the total pay of connected CEOs and that of unconnected CEOs. Consistent with the literature on CEO pay (e.g., Custódio et al. [28]), larger firms with more growth opportunities, higher R&D investments, and greater stock return volatility award their CEOs higher pay. Firms with smaller boards and more independent directors pay their CEOs more.

In Column (2), the dependent variable is excess pay. We find an insignificant coefficient on the connect dummy, which means that connected CEOs and unconnected CEOs receive similar excess pay. Overall, the results suggest that connected CEOs do not receive significantly higher pay than unconnected CEOs, contradicting the hypothesis that boards render favors to connected CEO candidates. The results are in contrast to Hwang and Kim [63]'s results. Hwang and Kim [63] find that connected CEOs are associated with higher pay.

2.7 Conclusion

In this paper, we study the net benefit for a firm to hire a CEO with pre-existing professional ties with its board of directors. We first show that a CEO candidate's pre-existing board connections are associated with a significant increase in the probability that the candidate is selected by the firm. We then examine changes in firm operating performance and market value around CEO turnovers, and find the performance improvements are significantly higher when the new CEOs are connected with the boards than when they are unconnected.

[23] The fiscal years new CEOs join are usually not full years, and the recorded CEO compensation is thus usually partial. We can extrapolate and standardize the partial year compensation, but may at the same time introduce bias as we assume CEOs are compensated equally each day. Hence, we use the total pay reported in the subsequent fiscal year in our analysis.

These findings support the hypothesis that boards select CEO candidates that they are acquainted with, and that this practice is in the best interest of the shareholders. Moreover, the performance effect of connected hiring is concentrated in the subsample of firms with greater information asymmetry, higher CEO termination risk, or larger board-CEO coordination costs. We also investigate CEO compensation but do not find evidence that connected CEOs are given more generous pay packages upon hiring, a prediction by the competing hypothesis that boards hire connected CEOs as favors to friends.

Our paper contributes to three strands of literature by providing novel evidence on how social network could impact CEO labor market outcomes and firm performance. First, we contribute to the discussion about the benefit and cost of professional and social connections between corporate CEOs and boards (e.g., Hwang and Kim [63], Fracassi and Tate [46], Coles et al. [24]). Second, we add to the literature studying boards' advising roles based on social connections (e.g., Cai and Sevilir [19], Goldman et al. [51], Ishii and Xuan [65]). Finally, we contribute to research on the determinants and impacts of CEO selection decisions (e.g., Gabaix and Landier [49], Custódio and Metzger [29], Pan [91]).

2.8 Tables

Table 1: Summary Statistics of the Event-Candidate Samples

This table presents summary statistics of candidate characteristics in three hiring event-candidate samples. Panel A reports summary statistics of the smallest sample in which all the CEOs hired each year are selected as potential candidates for each hiring company. Panel B reports summary statistics for the same variables in a sample where all the CEOs hired each year and the prior year are considered as valid candidates for each hiring company. Panel C reports summary statistics for the sample in which top 5 executives in office the previous year and this year are selected as potential candidates for each hiring company. Detailed variable definitions appear in the Appendix.

	#Obs	Mean	St. Dev.	P25	P50	P75
Panel A						
HIRED × 100	27,545	2.458	15.484	0.000	0.000	0.000
CONNECT	27,545	0.188	0.394	0.000	0.000	0.000
AGE	27,545	52.165	5.693	49.000	52.000	56.000
MISSING DOB	27,545	0.044	0.206	0.000	0.000	0.000
GENDER	27,545	0.957	0.204	1.000	1.000	1.000
MBA	26,792	0.478	0.500	0.000	0.000	1.000
CEO EXP	27,545	0.734	0.442	0.000	1.000	1.000
CHAIRMAN EXP	27,545	0.140	0.347	0.000	0.000	0.000
OTHER EXEC EXP	27,545	0.409	0.492	0.000	0.000	1.000
PUBLIC EXP	27,545	0.708	0.455	0.000	1.000	1.000
# COMPANIES	27,545	2.305	1.931	1.000	2.000	3.000
Panel B						
HIRED × 100	2,011,715	0.034	1.830	0.000	0.000	0.000
CONNECT	2,011,715	0.007	0.083	0.000	0.000	0.000
AGE	2,011,716	51.503	9.001	45.000	51.503	57.000
MISSING DOB	2,011,716	0.067	0.250	0.000	0.000	0.000
GENDER	2,011,715	0.930	0.254	1.000	1.000	1.000
MBA	1,835,234	0.382	0.486	0.000	0.000	1.000
CEO EXP	2,011,715	0.318	0.466	0.000	0.000	1.000
CHAIRMAN EXP	2,011,715	0.179	0.384	0.000	0.000	0.000
OTHER EXEC EXP	2,011,715	0.569	0.495	0.000	1.000	1.000
PUBLIC EXP	2,011,715	0.671	0.470	0.000	1.000	1.000
# COMPANIES	2,011,715	2.208	2.399	1.000	2.000	3.000
Panel C						
HIRED × 100	5,593,178	0.012	1.100	0.000	0.000	0.000
CONNECT	5,593,178	0.008	0.087	0.000	0.000	0.000
AGE	5,593,179	50.520	7.985	47.000	50.520	54.000
MISSING DOB	5,593,179	0.299	0.458	0.000	0.000	1.000
GENDER	5,593,178	0.913	0.281	1.000	1.000	1.000
MBA	5,030,904	0.341	0.474	0.000	0.000	1.000
CEO EXP	5,593,178	0.577	0.494	0.000	1.000	1.000
CHAIRMAN EXP	5,593,178	0.111	0.314	0.000	0.000	0.000
OTHER EXEC EXP	5,593,178	0.373	0.484	0.000	0.000	1.000
PUBLIC EXP	5,593,178	0.310	0.462	0.000	0.000	1.000
# COMPANIES	5,593,178	1.929	1.971	1.000	1.000	3.000

Table 2: Propensity to Hire

This table presents regression results of a propensity to hired model. The dependent variable equals one if a candidate is newly hired by a firm in a year, and zero otherwise. Columns (1) presents the regression results with the small sample, in which we assume all the CEOs hired this year in our sample as potential candidates for each hiring company. Columns (2) report the regression results of a similar model but in a medium sample constructed assuming all the newly appointed CEOs, chairmen, and other chief executives of all public firms as potential candidates for each hiring company. Columns (3) reports the regression results of similar models but in a large sample which considers all the candidates in the medium sample plus newly hired CEOs of private firms as potential candidates for each hiring company each year. We do not include control variables in models reported in Column (1). We control for key candidate characteristics including age, gender, MBA experience, public firm experience, and number of companies worked for in columns (2) and (3). Detailed definitions of variables are listed in the appendix. We further include hiring firm fixed effects and year fixed effects to further control for unobserved heterogeneity. Standard errors are clustered at hiring firm level. T-stats are reported in parentheses. Average marginal effects are reported in brackets below t-stats. *, **, and *** indicate statistical significance of the differences at the 10%, 5%, and 1% level, respectively.

	Small Sample (1)	Medium Sample (2)	Large Sample (3)
CONNECT	1.584***	2.480***	2.452***
	(8.90)	(12.33)	(12.56)
	[0.0375]	[0.0009]	[0.0003]
AGE		0.012***	0.024***
		(3.29)	(7.14)
MISSING DOB		-0.476**	-2.119***
		(-2.46)	(-10.53)
GENDER		0.462**	0.633***
		(2.27)	(3.12)
MBA		0.428***	0.518***
		(5.38)	(6.44)
CEO EXP		0.939***	-0.221**
		(10.56)	(-2.40)
CHAIRMAN EXP		-0.197	-0.087
		(-1.52)	(-0.63)
OTHER EXEC EXP		-0.061	-0.103
		(-0.63)	(-0.96)
PUBLIC EXP		-1.107***	0.372***
		(-9.50)	(3.52)
# COMPANIES		-0.096***	-0.132***
		(-3.31)	(-4.02)
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Observations	27,545	1,798,607	4,945,779

Table 3: Comparison between Connected and Unconnected CEOs

This table summarizes and compares the characteristics of the firms that hire connected CEO candidates to the characteristics of the firms that hire unconnected CEO candidates. The columns labeled "N" reports the number of observations of the two groups. The columns labeled "MEAN" and "S. D." reports the means and standard deviations of the characteristics of the two groups. The column labeled "DIFF" presents the differences between the means of the two groups, and the column labeled "S. E." reports the standard errors of the differences. *, **, and *** indicate statistical significance of the differences at the 10%, 5%, and 1% level, respectively.

	CONNECTED			UNCONNECTED			COMPARISON	
	N	MEAN	S. D.	N	MEAN	S. D.	DIFF	S. E.
Firm Characteristics								
SIZE	190	7.432	1.677	478	7.517	1.614	-0.085	0.140
# SEGMENTS	190	2.500	1.603	484	2.521	1.762	-0.021	0.147
ROA	190	0.007	0.144	478	0.007	0.135	-0.000	0.012
OROA	190	0.111	0.137	478	0.111	0.133	0.001	0.011
R&D	190	0.042	0.075	478	0.033	0.072	0.010*	0.006
CAPX	188	0.047	0.057	474	0.049	0.063	-0.002	0.005
SG	190	0.082	0.456	478	0.067	0.315	0.016	0.031
LN(Q)	190	0.939	0.307	478	0.954	0.305	-0.015	0.026
OPACITY	172	0.056	0.060	420	0.050	0.041	0.007	0.004
LEV	190	0.220	0.192	478	0.234	0.204	-0.014	0.017
DIV	190	0.009	0.021	478	0.012	0.022	-0.003	0.002
REP	190	0.021	0.041	478	0.026	0.050	-0.005	0.004
VOL	189	0.134	0.067	476	0.130	0.072	0.004	0.006
BOARD SIZE	190	9.079	2.251	484	8.992	2.349	0.087	0.199
BOARD IND	190	0.846	0.093	484	0.846	0.103	-0.000	0.009
BOARD BUSY	190	0.248	0.207	484	0.280	0.223	-0.032*	0.019
FORCE	190	0.353	0.479	484	0.267	0.443	0.086**	0.039
CEO Characteristics								
CEO TALENT	190	44.984	11.631	484	44.895	11.450	0.090	0.985
# CONNECTIONS	190	758.900	979.922	484	661.523	873.677	97.377	77.463
AGE	189	54.143	6.122	481	51.894	5.671	2.249***	0.498
GENDER	190	0.968	0.175	484	0.955	0.209	0.014	0.017
MBA DEGREE	189	1.804	1.050	479	1.746	1.032	0.058	0.089
CEO EXP	190	0.500	0.501	484	0.469	0.500	0.031	0.043
OTHER EXECUTIVE EXP	190	0.368	0.484	484	0.444	0.497	-0.076*	0.042
CHAIRMAN EXP	190	0.242	0.429	484	0.107	0.310	0.135***	0.030
PUBLIC EXP	190	0.553	0.499	484	0.434	0.496	0.119***	0.043
# COMPANIES	190	1.495	1.172	484	1.421	1.524	0.073	0.123

Table 4: Connected Hire and Firm Performance

This table presents diff-in-diff regression results using firm performance measures as dependent variables. We focus on a sample of firms that hire new CEOs and track 3 years before and 2 years after the new CEO appointment. Panel A reports results of estimating the following model.

$$Y_{i,t} = \beta \times \text{CONNECT}_i \times \text{POST}_{i,t} + \gamma \times \text{POST}_{i,t} + \psi' X_{i,t-1} + \lambda_i + \alpha_t + \varepsilon_{i,t}$$

where i indexes firm and t indexes time. Dependent variable $Y_{i,t}$ is the corporate performance measures of interest including ROA and Tobin's Q. CONNECT represents the treatment dummy, which equals one for firms that hire connected CEOs and zero otherwise, and POST represents the time dummy, which equals one for the year in which the CEO joins and the two subsequent years and zero otherwise. $X_{i,t-1}$ marks lagged firm and board characteristics as controls and includes SIZE, CAPX, R&D, DIV, VOL, BOARD SIZE, BOARD IND and BOARD BUSY. Detailed definitions of variables are listed in the appendix. λ_i represents firm fixed effects and α_i represents year fixed effects. Panel B reports results of a similar model but replacing POST dummy with relative year fixed effects. Namely, we estimate

$$Y_{i,t} = \sum_{y=-2}^{2} \beta_y \times \text{CONNECT}_i \times \text{Dum}_{i,t,y} + \sum_{y=-2}^{2} \gamma_y \times \text{Dum}_{i,t,y} + \psi' X_{i,t-1} + \lambda_i + \alpha_t + \varepsilon_{i,t}$$

where y indexes year relative to event year and ranges from -2 to 2. $\text{Dum}_{i,t,y}$ is a dummy variable which equals one if an observation is in relative year y, and zero otherwise. T-stats are reported in the parentheses. Standard errors are clustered at 2-digit SIC level. *, **, and *** indicate statistical significance of the estimated coefficients at the 10%, 5%, and 1% level, respectively.

Panel A: Performance Improvement of Connected CEOs

	ROA (1)	LN(Q) (2)
CONNECT × POST	0.015**	0.039**
	(2.30)	(2.22)
POST	0.004	0.002
	(0.89)	(0.13)
SIZE	-0.066***	-0.156***
	(-3.81)	(-5.90)
CAPX	0.171***	0.050
	(2.70)	(0.35)
R&D	-0.238***	0.386***
	(-2.92)	(3.43)
DIV	0.225	0.851**
	(0.99)	(2.23)
VOL	0.036	0.138
	(0.71)	(1.27)
BOARD SIZE	-0.002	-0.006
	(-1.00)	(-1.55)
BOARD IND	0.027	-0.053
	(0.71)	(-0.64)
BOARD BUSY	-0.001	-0.002
	(-0.03)	(-0.11)
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
R^2	0.560	0.791
Observations	3,517	3,515

Panel B: Parallel Trend

	ROA (1)	LN(Q) (2)
CONNECT × Dum_{-2}	-0.017	0.010
	(-1.17)	(0.41)
CONNECT × Dum_{-1}	0.003	0.017
	(0.21)	(0.87)
CONNECT × Dum_{0}	0.013	0.041*
	(1.15)	(1.88)
CONNECT × Dum_{1}	-0.001	0.041**
	(-0.12)	(2.02)
CONNECT × Dum_{2}	0.023**	0.054**
	(1.98)	(2.13)
Dum_{-2}	-0.001	-0.023***
	(-0.13)	(-2.97)
Dum_{-1}	-0.019***	-0.046***
	(-3.15)	(-3.58)
Dum_{0}	-0.011*	-0.030
	(-1.69)	(-1.38)
Dum_{1}	0.002	-0.021
	(0.31)	(-0.82)
Dum_{2}	-0.002	-0.017
	(-0.19)	(-0.58)
SIZE	-0.065***	-0.154***
	(-3.79)	(-5.82)
CAPX	0.175**	0.051
	(2.65)	(0.36)
R&D	-0.241***	0.384***
	(-2.97)	(3.42)
DIV	0.204	0.818**
	(0.91)	(2.15)
VOL	0.037	0.142
	(0.74)	(1.33)
BOARD SIZE	-0.003	-0.006
	(-1.05)	(-1.66)
BOARD IND	0.032	-0.048
	(0.82)	(-0.60)
BOARD BUSY	0.000	-0.002
	(0.00)	(-0.10)
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
R^2	0.563	0.792
Observations	3,517	3,515

Table 5: Robustness of Long-term Performance Results to Additional Controls

This table presents diff-in-diff regression results using firm performance measures as dependent variables. We focus on a sample of firms that hire new CEOs and track 3 years before and 2 years after the new CEO appointment. We take the model estimated in Table 4 and add additional controls for characteristics of CEOs and turnover firms. Namely, we estimate

$$Y_{i,t} = \beta \times \text{CONNECT}_i \times \text{POST}_t + \gamma \times \text{POST}_t + \zeta \times Z_{i,t} + \eta \times Z_{i,t} \times \text{POST}_t + \psi' X_{i,t-1} + \lambda_i + \alpha_t + \varepsilon_{i,t}$$

where i indexes firm and t indexes time. Dependent variable $Y_{i,t}$ is the corporate performance measures of interest including ROA and Tobin's Q. CONNECT represents the treatment dummy, which equals one for firms that hire connected CEOs and zero otherwise, and POST represents the time dummy, which equals one for the year in which the CEO joins and the two subsequent years and zero otherwise. $Z_{i,t}$ represents additional control variables that relates to each CEO turnover event, and includes FORCED, # CONNECTIONS, CEO TALENT, BUSY IND, AGE, OTHER EXEC EXP, CHAIRMAN EXP and PUBLIC EXP. $X_{i,t-1}$ marks lagged firm and board characteristics as controls and includes SIZE, CAPX, R&D, DIV, VOL, BOARD SIZE, BOARD IND and BOARD BUSY. Detailed definitions of variables are listed in the appendix. λ_i represents firm fixed effects and α_i represents year fixed effects. T-stats are reported in the parentheses. Standard errors are clustered at 2-digit SIC level. *, **, and *** indicate statistical significance of the estimated coefficients at the 10%, 5%, and 1% level, respectively.

Panel A: Robustness to Forced Turnover, CEO Talent, and CEO Network

	ROA (1)	LN(Q) (2)	ROA (3)	LN(Q) (4)	ROA (5)	LN(Q) (6)	ROA (7)	LN(Q) (8)
CONNECT × POST	0.016**	0.043**	0.016**	0.042**	0.013**	0.038**	0.016***	0.047**
	(2.55)	(2.36)	(2.36)	(2.47)	(2.20)	(2.05)	(2.75)	(2.47)
POST	0.002	0.007	0.002	0.006	0.007	-0.005	0.002	0.005
	(0.44)	(0.36)	(0.30)	(0.29)	(0.21)	(-0.07)	(0.05)	(0.07)
FORCED	-0.027**	-0.035					-0.023	-0.035
	(-2.03)	(-0.82)					(-1.66)	(-0.83)
FORCED × POST	0.004	-0.024					-0.000	-0.033*
	(0.42)	(-1.39)					(-0.04)	(-1.88)
# CONNECTIONS			0.001	0.004**			0.001	0.004**
			(1.31)	(2.38)			(1.35)	(2.49)
# CONNECTIONS × POST			0.049**	-0.030			0.048*	-0.041
			(2.15)	(-0.36)			(1.71)	(-0.48)
CEO TALENT					-0.112	-0.020	-0.112	-0.019
					(-1.29)	(-0.11)	(-1.16)	(-0.10)
CEO TALENT × POST					-0.007	0.012	-0.004	0.013
					(-0.10)	(0.09)	(-0.05)	(0.10)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.561	0.792	0.562	0.792	0.566	0.790	0.568	0.793
Observations	3,517	3,515	3,517	3,515	3,354	3,352	3,354	3,352

Panel B: Robustness to Busy Directors, CEO Age, and CEO Experiences

	ROA (1)	LN(Q) (2)	ROA (3)	LN(Q) (4)	ROA (5)	LN(Q) (6)	ROA (7)	LN(Q) (8)	ROA (9)	LN(Q) (10)	ROA (11)	LN(Q) (12)
CONNECT × POST	0.015**	0.039**	0.016**	0.041**	0.015**	0.037**	0.017***	0.044**	0.016**	0.038**	0.017**	0.039**
	(2.34)	(2.18)	(2.34)	(2.29)	(2.34)	(2.06)	(2.79)	(2.58)	(2.37)	(2.18)	(2.31)	(2.19)
POST	0.002	0.005	0.019	0.025	0.002	0.005	0.004	0.001	0.004	-0.006	0.010	0.038
	(0.38)	(0.31)	(0.34)	(0.29)	(0.31)	(0.24)	(0.80)	(0.02)	(0.57)	(-0.28)	(0.21)	(0.45)
BUSY IND	0.014	0.108									-0.001	0.098
	(0.37)	(1.25)									(-0.03)	(1.13)
BUSY IND × POST	0.007	-0.013									0.006	-0.030
	(0.42)	(-0.46)									(0.33)	(-1.13)
AGE			-0.002*	-0.004							-0.002	-0.003
			(-1.86)	(-1.30)							(-1.57)	(-1.25)
AGE × POST			-0.000	-0.000							-0.000	-0.001
			(-0.29)	(-0.31)							(-0.23)	(-0.40)
OTHER EXEC EXP					-0.015	-0.038					-0.009	-0.044
					(-0.72)	(-1.54)					(-0.42)	(-1.18)
OTHER EXEC EXP × POST					0.007	-0.001					0.008	-0.021
					(0.74)	(-0.08)					(0.73)	(-0.98)
CHAIRMAN EXP							-0.015	-0.057*			-0.003	-0.038
							(-0.57)	(-1.81)			(-0.11)	(-1.16)
CHAIRMAN EXP × POST							-0.004	-0.003			-0.004	-0.021
							(-0.30)	(-0.10)			(-0.27)	(-0.63)
PUBLIC EXP									-0.022	-0.031	-0.018	0.009
									(-1.18)	(-0.97)	(-0.92)	(0.21)
PUBLIC EXP × POST									0.002	0.019	0.001	0.028
									(0.21)	(1.08)	(0.10)	(1.24)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.560	0.791	0.565	0.791	0.561	0.791	0.560	0.791	0.561	0.791	0.566	0.793
Observations	3,517	3,515	3,336	3,334	3,517	3,515	3,517	3,515	3,517	3,515	3,336	3,334

Table 6: Connected Hire and Firm Performance, Subsample Comparisons

This table presents diff-in-diff regression results using firm performance measures as dependent variables while splitting firms into subsamples based on proxies for information asymmetry, innate/termination risk, and coordination costs. We focus on a sample of firms that hire new CEOs and track 3 years before and 2 years after the new CEO appointment. In panel A, we split firms based on information asymmetry measures (OPACITY and IO). In panel B and C we split firms into subsamples based on measures of termination risk (VOL and R&D) and coordination cost (BOARD SIZE) respectively. Columns (1) - (2) of panel A section (a) utilize the subsample of firms whose accounting opacity in the year before new CEO appointment is above the median of the sample. The dependent variables are ROA and logarithm of Q. Columns (3) - (4) replicate the tests in columns (1) - (2) utilizing the subsample of firms whose accounting opacity is below the median. Columns (5) and (6) reports the differences between the estimated coefficients using two subsamples. The results reported in the remaining sections (b) - (e) follow similar rationale and formatting to section (a), and split firms based on value of institutional ownership (IO), stock return volatility (VOL), R&D intensity (R&D), and board size (BOARD SIZE). We estimate Eq (2.1) using each subsample. We control for key firm and board characteristics including SIZE, CAPX, R&D, DIV, VOL, BOARD SIZE, BOARD IND and BOARD BUSY. Detailed definitions of variables are listed in the appendix. We include firm and year fixed effects to further control for unobserved heterogeneity. T-stats reported in the parentheses. Standard errors are clustered at 2-digit SIC level. *, **, and *** indicate statistical significance of the estimated coefficients at the 10%, 5%, and 1% level, respectively.

Panel A: Subsamples by information asymmetry

	ROA (1)	LN(Q) (2)	ROA (3)	LN(Q) (4)	ROA (5)	LN(Q) (6)
(a)	OPACITY ≥ Median		OPACITY < Median		DIFF	
CONNECT × POST	0.023**	0.041*	0.005	0.020	0.018	0.020
	(1.98)	(1.77)	(0.66)	(0.79)	(1.29)	(0.59)
R^2	0.587	0.789	0.565	0.829		
Observations	1,946	1,944	1,571	1,571		
(b)	IO < Median		IO ≥ Median		DIFF	
CONNECT × POST	0.028*	0.063**	0.007	0.025	0.021	0.037
	(1.66)	(2.07)	(0.61)	(1.12)	(1.05)	(0.99)
R^2	0.600	0.791	0.547	0.824		
Observations	1,559	1,559	1,958	1,956		

Panel B: Subsamples by termination risk

	ROA (1)	LN(Q) (2)	ROA (3)	LN(Q) (4)	ROA (5)	LN(Q) (6)
(c)	VOL ≥ Median		VOL < Median		DIFF	
CONNECT × POST	0.022*	0.077***	0.002	-0.008	0.019	0.085**
	(1.95)	(3.08)	(0.28)	(-0.30)	(1.37)	(2.29)
R^2	0.567	0.773	0.556	0.855		
Observations	1,686	1,685	1,831	1,830		
(d)	R&D ≥ Median		R&D < Median		DIFF	
CONNECT × POST	0.027***	0.040*	-0.004	0.036	0.031*	0.004
	(3.02)	(1.80)	(-0.26)	(1.16)	(1.81)	(0.10)
R^2	0.516	0.846	0.594	0.762		
Observations	1,777	1,777	1,740	1,738		

Panel C: Subsample by coordination costs

	ROA (1)	LN(Q) (2)	ROA (3)	LN(Q) (4)	ROA (5)	LN(Q) (6)
(e)	BOARD SIZE ≥ Median		BOARD SIZE < Median		DIFF	
CONNECT × POST	0.022***	0.050**	0.002	0.022	0.019	0.029
	(4.03)	(2.48)	(0.12)	(0.54)	(1.00)	(0.63)
R^2	0.592	0.815	0.569	0.786		
Observations	1,973	1,972	1,544	1,543		

Table 7: M&A Announcement CAR

This table presents regression results on cumulative abnormal returns of bidders over the 5 days around M&A announcements. We collect all the M&A announcements during the tenures of the CEOs in our sample. The dependent variable is CAR, the cumulative abnormal returns of the acquirers from two days before to two days after the deal announcement. The dummy variable, CONNECT, equals one if an M&A announcement is made by a firm with a connected CEO, and zero otherwise. We follow Cai and Sevilir [19] and Schmidt [102] in selecting control variables. Detailed definitions of variables are listed in the appendix. All models include year and industry (2-digit SIC) fixed effects. T-stats reported in the parentheses are based on standard errors clustered at industry level. *, **, and *** indicate statistical significance of the estimated coefficients at the 10%, 5%, and 1% level, respectively.

Panel A: Summary Statistics of CAR by Group

CAR	#Obs	Mean	St. Dev.	Median
Announcement by Connected CEO	77	0.022	0.066	0.014
Announcement by Unconnected CEO	216	-0.005	0.067	0.003
Difference between the Means		0.027*** (3.07)		

Panel B: Regression Results

	CAR (1)	CAR (2)	CAR (3)	CAR (4)
CONNECT	0.023**	0.025**	0.020**	0.023**
	(2.13)	(2.34)	(2.20)	(2.09)
CEO TALENT		0.001	0.001	0.000
		(0.73)	(0.73)	(0.45)
MISSING DOB		0.015	0.019	0.000
		(0.31)	(0.36)	(0.00)
# CONNECTIONS		0.000	0.000	0.000
		(1.24)	(1.13)	(1.33)
STOCK DEAL		-0.035**	-0.041**	-0.045**
		(-2.10)	(-2.28)	(-2.58)
DIVERSIFYING ACQUISITION		-0.025**	-0.026**	-0.036***
		(-2.44)	(-2.26)	(-3.26)
RELATIVE DEAL SIZE		-0.014	-0.004	0.011
		(-0.32)	(-0.09)	(0.20)
MISS RELATIVE DEAL SIZE		-0.011	-0.016	-0.019
		(-1.12)	(-1.44)	(-1.43)
TENDER OFFER		0.015	0.017*	0.016
		(1.21)	(1.71)	(1.20)
HOSTILE		0.035	0.011	0.048
		(1.24)	(0.28)	(0.74)
TOEHOLD		0.002	-0.004	-0.004
		(0.18)	(-0.31)	(-0.33)
ACQUIRER SIZE			0.001	0.003
			(0.19)	(0.58)
ACQUIRER Q			0.003	0.009**
			(0.69)	(2.25)
ACQUIRER LEV			-0.026	-0.038
			(-0.76)	(-0.81)
ACQUIRER OCF			0.009	0.004
			(0.15)	(0.06)
ACQUIRER RUN-UP			-0.009**	-0.007
			(-2.41)	(-1.69)
ACQUIRER BOARD SIZE			0.001	0.001
			(0.26)	(0.41)
ACQUIRER BOARD IND			0.068	0.054
			(1.39)	(1.07)
MISS ACQUIRER BOARD IND			0.060	0.048
			(1.28)	(1.10)
ACQUIRER BOARD BUSY			0.006	0.012
			(0.50)	(0.86)
TARGET Q				-0.009**
				(-2.45)
TARGET LEV				0.004
				(0.09)
TARGET OCF				0.012
				(0.36)
TARGET RUN-UP				-0.000
				(-0.62)
Year Fixed Effects	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES
R^2	0.291	0.355	0.402	0.443
#Obs	293	293	277	250

Table 8: Connection and CEO Compensation

This table presents regression results on CEO compensation. In columns (1) and (2), the dependent variables are CEO total pay and excess CEO pay in the first full year of the new CEO, respectively. CEO total pay is the TDC1 variable reported in ExecuComp. Excess CEO pay is computed as residual from a regression of CEO TOTAL PAY on firm size (SIZE), industry fixed effects (3-digit SIC), and the interaction of the two, estimated using all CEOs in ExecuComp from 2000 to 2018. The independent variable of interest, CONNECT, is a dummy variable indicating whether a newly hired CEO is connected to the board of the hiring company. We control for key firm and board characteristics including SIZE, ROA, PAST RET, LN(Q), CAPX, R&D, DIV, VOL, BOARD SIZE, BOARD IND and BOARD BUSY for both models. Detailed definitions of variables are listed in the appendix. We further include industry (2-digit SIC) and year fixed effects to control for unobserved heterogeneity. T-stats reported in the parentheses are based on standard errors clustered at industry level (2-digit SIC). *, **, and *** indicate statistical significance of the estimated coefficients at the 10%, 5%, and 1% level, respectively.

	TOTAL PAY (1)	EXCESS PAY (2)
CONNECT	-327.545	-431.704
	(-0.74)	(-0.98)
SIZE	2738.921***	-132.849
	(13.74)	(-0.55)
ROA	-623.233	-1561.922
	(-0.47)	(-1.09)
PAST RET	-443.132	-266.604
	(-0.81)	(-0.55)
LN(Q)	3080.712***	1350.334
	(2.92)	(1.41)
CAPX	-2320.979	-2955.119
	(-1.09)	(-1.35)
R&D	4934.144***	3716.417**
	(3.04)	(2.31)
DIV	-14036.593	-9260.481
	(-1.32)	(-0.82)
VOL	7569.857**	7163.139**
	(2.46)	(2.01)
BOARD SIZE	-318.334**	-305.237**
	(-2.57)	(-2.14)
BOARD BUSY	370.722	-296.040
	(0.66)	(-0.46)
BOARD IND	3963.350**	5007.978***
	(2.58)	(3.31)
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes
R^2	0.518	0.293
Observations	633	631

Appendices

Appendix A

Appendices for Chapter 1

A Variable Definitions

Table A1: Variable Definitions

Variable Name	Definition
Board Characteristics	
Academic board	A dummy variable equals one if a firm has at least one academic director serving on the board in a given year.
% Academic	Percentage of independent directors who are from academia in a given year.
Industry PhD board	A dummy variable equals one if a company has at least one industry PhD board director and no academic director serving on the board of directors in a given year, and zero otherwise.
STEM	A dummy variable equals one if a firm has at least one STEM academic director in a given year.
BUS	A dummy variable equals one if a firm has at least one BUS academic director in a given year.
OTH	A dummy variable equals one if a firm has at least one OTH academic director in a given year.
Board size	Total number of board members serving on the board of directors in a year.
% Independent	Percentage of board members who are independent in a year.
CEO duality	A dummy variable equals one if the CEO serves as chairman of the board.
Director Characteristics	
Academic director	A dummy variable equals one if an independent board member holds a PhD degree *and* has an academic career. To identify the board members with a PhD degree, we use the director education file in BoardEx and search the following keywords in the qualifications of directors: "PhD", "Doctor", "Doctorate", "Doctoral", "Postdoctoral", "DPhil", "Dr", "MD", "DM", "PharmD", "DDS", "DSc", "DVM", "ScD", "DMD", "DEng", "DPM", "VMD", "DMSc", "DHA", and "DDM". To recognize the directors whose primary career is in academia, we use the director employment file and search both the word "Professor" in the role name and the following keywords in the company name: "Universify", "School of", "Business School", "Medical School", "Institute of", "College". We exclude "Acting Professor", "Adjunct Professor", "Guest Professor", and "Honorary Professor" because those titles are either temporary or granted for the contributions made to school or community.
STEM	A dummy variable equals one if an academic director has a medicine, science, technology, engineering or mathematics background.
BUS	A dummy variable equals one if an academic director has a business, economics or law background.
OTH	A dummy variable equals one if an academic director's discipline does not fall into the STEM or BUS category.
# Directorships	Number of corporate boards a director is currently serving.
Director tenure	Number of years the director has served on the board of directors of the current firm.
Director age	The age of the director measured in years.

Table A1: Variable Definitions

Name	Definition
Retirement age	A dummy variable equals one if the director reaches the retirement age of 70, and zero otherwise.
Firm Characteristics	
Assets	Dollar value (in millions) of total inflation adjusted assets (AT).
Size	Logarithm of 1 plus assets.
Age	The number of years a firm is included in the CRSP database.
# Segments	Number of business segments.
Tobin's Q	Book assets (AT) minus the book value of equity plus the market value of equity (ME) divided by book assets (AT).
ROA	Income Before Extraordinary Items (IB) scaled by beginning book assets (AT).
Ind-adj. ROA	Firm's return on assets minus the ROA of the median firm in the same industry (2-digit SIC) in a year.
Stock return	Stock return over a fiscal year calculated by compounding monthly CRSP stock returns.
Ind-adj. stock return	Firm's stock return minus the stock return of the median firm in the same industry (2-digit SIC) in a year.
Volatility	Monthly stock return standard deviation of a firm over the past 3 fiscal years.
Sales growth	Total sales (SALE) divided by last period total sales minus 1.
Tangibility	Net PP&E (PPENT) as a percentage of total fixed assets (AT−ACT).
Cash	Cash and short term investments (CHE) divided by beginning period assets (AT).
Leverage	Total long-term debt (DLT) plus debt in current liabilities (DLC) scaled by beginning period total assets (AT).
R&D	R&D expenses (XRD) divided by beginning period total assets (AT). Missing values are set to zero.
High R&D	A dummy variable equals one if the firm's R&D is greater than the median R&D in our sample, and zero otherwise.
CAPX	Capital expenditures (CAPX) divided by beginning period total assets (AT).
Dividend	Dividend to common shareholders (DVC) divided by beginning period total assets (AT). If DVC is missing, we use the difference between total dividends (DVT) and preferred dividends (DVP). Missing values are set to zero.
Repurchase	Repurchase of common stock (PRSTKCC) divided by by beginning period total assets (AT). If PRSTKCC is missing, we use the difference between total purchase of stock and purchase of preferred stock (PRSTKC − PRSTKPC). Missing values are set to zero.
Stock issues	Sales of stock (SSTK) divided by beginning period book assets (AT).
# Analyst	Total number of distinct analysts making fiscal year-end predictions for a firm within a fiscal year.
Institutional ownership	Number of shares hold by institutions as a percentage of total firm shares outstanding.
Mature firm	A dummy variable equals one if a firm is classified as a mature firm. To classify mature firms, we sort firms into deciles by size (from low to high), age (from low to high), and leverage (from high to low) independently. We assign scores 1 to 10 to each decile and sum up the scores. If a firm scores higher than 15, then that firm is labeled as a mature firm.

Table A1: Variable Definitions

Name	Definition
Ln(Patent)	The logarithm of one plus total number of patents filed for each year.
Ln(Cite)	The logarithm of one plus total number of citations received by patents filed for each year.
Ln(Tcw)	The logarithm of citation-weighted patent counts (Hall et al. [56], Kogan et al. [76]). $Tcw_{f,t} = \frac{\sum_{j \in P_{f,t}} \left(1 + \frac{C_j}{\bar{C}_j}\right)}{A_{f,t}}$ where $P_{f,t}$ is the set of patents issued to firm f in fiscal year t, C_j is the number of forward citations received by patent j, $\bar{C}_j$ is the average number of forward citations received by all the patents that were granted in the same year as patent j, and $A_{f,t}$ is the book assets at the end of fiscal year t. The data of forward citations are from Prof. Noah Stoffman's website.
Disc accruals	Discretionary accruals measured in (Kothari et al. [77]), which is the absolute value of the residuals from the following cross-sectional regression estimated for every industry (2-digit SIC) and year with at least 15 observations: $\frac{TA_t}{Asssets_{t-1}} = k_1 \frac{1}{Assets_{t-1}} + k_2 \frac{(\Delta SALE_t - \Delta AR_t)}{Assets_{t-1}} + k_3 \frac{PPE_t}{Assets_{t-1}} + k_4 ROA_t + \varepsilon_t$ where TA is change in current asset (ACT) - change in cash (CHE) - change in current liabilities (LCT) + change in debt (DLC) - depreciation and amortization (DP).
Abnormal CFO	Abnormal CFO is the difference between the actual CFO and the predicted CFO. To estimate the predicted CFO, we run the following cross-sectional regression estimated for every industry (2-digit SIC) and year with at least 15 observations (Roychowdhury [99]): $\frac{CFO_t}{Asssets_{t-1}} = k_1 \frac{1}{Assets_{t-1}} + k_2 \frac{SALE_t}{Assets_{t-1}} + k_3 \frac{\Delta SALE_t}{Assets_{t-1}} + \varepsilon_t$ where CFO is operating cash flows (OANCF).
Abnormal prod	Abnormal production costs, which is the actual production costs minus the predicted production costs. To estimate the predicted production costs, we run the following cross-sectional regression for every industry (2-digit SIC) and year with at least 15 observations (Roychowdhury [99]): $\frac{PROD_t}{Asssets_{t-1}} = k_1 \frac{1}{Assets_{t-1}} + k_2 \frac{SALE_t}{Assets_{t-1}} + k_3 \frac{\Delta SALE_t}{Assets_{t-1}} + k_4 \frac{\Delta SALE_{t-1}}{Assets_{t-1}} + \varepsilon_t$ where PROD is cost of goods sold (COGS) plus changes in inventory.

Table A1: Variable Definitions

Name	Definition
Abnormal exp	Abnormal discretionary expenses, which is the actual discretionary expenses minus the predicted discretionary expenses. To estimate the predicted discretionary expenses, we run the following cross-sectional regression for every industry (2-digit SIC) and year with at least 15 observations (Roychowdhury [99]): $$\frac{DISEXP_t}{Asssets_{t-1}} = k_1 \frac{1}{Assets_{t-1}} + k_2 \frac{SALE_{t-1}}{Assets_{t-1}} + \varepsilon_t$$ where DISEXP is the sum of R&D expense (XRD), advertising expense (XAD), and SG&A expense (XSGA).
Abnormal R&D exp	Abnormal R&D expenses, which is the actual R&D expenses minus the predicted R&D expenses. To estimate the predicted R&D expenses, we run the following cross-sectional regression for every industry (2-digit SIC) and year with at least 15 observations: $$\frac{XRD_t}{Asssets_{t-1}} = k_1 \frac{1}{Assets_{t-1}} + k_2 \frac{SALE_{t-1}}{Assets_{t-1}} + \varepsilon_t$$
CEO Characteristics	
PhD CEO	A dummy variable equals one if a CEO holds a PhD degree, and zero otherwise. We use the definition in He and Hirshleifer [61] to identify PhD CEOs by searching the following keywords in the qualifications of CEOs in the director education file in BoardEx: “Doctor”, “Doctorate”, “Dr”, “DPhil”,“PhD”, “Doctoral”, “Postdoctoral”, “PharmD”, “DDM”, “DDS”, “DEng”, “DMSc”, “DPM”, “DSc”, “DM”, “DMD”, “DHA”, “DVM”, “MD”, “ScD” and “VMD”.
CEO tenure	Number of years the CEO has worked in the current company.
CEO age	Age of the CEO, in years.
CEO ownership	Number of shares owned by the CEO divided by firm’s total shares outstanding.

B Academic Board Heterogeneity and Innovation

Table B1: Academic Board Heterogeneity and Innovation

This table reports the panel regression results on the heterogeneous effect of different number of academic directors on firm innovation. We re-estimate the models in Table 5 and Table 6 replacing the academic board dummy with a dummy indicating the boards with exactly one academic director and a dummy indicating the boards with two or more academic directors. The dependent variables are R&D, Ln(Patent), Ln(Cite), and Ln(Tcw) in Columns (1) - (4), respectively. We control for PhD CEO, Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(CEO tenure), Ln(CEO age), CEO ownership, and Ln(# Analyst). More detailed definitions of variables are reported in the Appendix. Industry and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	R&D (1)	Ln(Patent) (2)	Ln(Cite) (3)	Ln(Tcw) (4)
Academic board – one academic director	0.006***	0.132**	0.145**	0.128**
	(3.08)	(2.38)	(1.97)	(2.27)
Academic board – more than one academic director	0.019***	0.431***	0.542***	0.458***
	(5.35)	(4.12)	(4.04)	(4.24)
PhD CEO	0.027***	0.372***	0.535***	0.340***
	(6.18)	(3.82)	(4.06)	(3.33)
Size	-0.007***	0.461***	0.538***	0.436***
	(-8.26)	(15.15)	(14.37)	(14.16)
Ln(Age)	-0.000	0.163***	0.140***	0.105***
	(-0.47)	(5.44)	(3.59)	(3.51)
Sales growth	0.011***	-0.028	0.010	0.005
	(4.53)	(-0.56)	(0.14)	(0.09)
Ln(Tobin's Q)	0.053***	0.892***	1.217***	0.957***
	(15.21)	(11.05)	(11.05)	(10.88)
ROA	-0.163***	-1.073***	-1.716***	-1.093***
	(-15.10)	(-6.55)	(-7.04)	(-5.85)
Leverage	-0.032***	-0.900***	-1.078***	-0.853***
	(-7.10)	(-6.77)	(-6.10)	(-6.16)
Institutional ownership	-0.007*	-0.426***	-0.545***	-0.458***
	(-1.93)	(-4.35)	(-4.48)	(-4.77)
Ln(CEO tenure)	0.003***	0.005	-0.006	0.018
	(3.08)	(0.17)	(-0.15)	(0.59)
Ln(CEO age)	-0.033***	-0.870***	-0.958***	-0.833***
	(-4.66)	(-4.44)	(-3.55)	(-4.00)
CEO ownership	-0.000*	0.001	-0.001	0.001
	(-1.79)	(0.14)	(-0.14)	(0.16)
Ln(# Analyst)	0.009***	0.196***	0.277***	0.205***
	(7.34)	(5.44)	(5.97)	(5.73)
Industry & Year FE	Yes	Yes	Yes	Yes
N	21489	21490	21490	21490
R^2	0.501	0.512	0.484	0.462

C DID Parallel Trend Assumption

Table C1: DID Parallel Trend Assumption

This table reports the results validating the parallel trend assumption underlying diff-in-diff models in Table 7. We define five year dummies relative to the year of director departure ($year_{t-2}$ – $year_{t+2}$). We estimate the same diff-in-diff models but replace *Academic Director Departure*×*Post* by the interactions between the Academic Director Departure dummy and each year dummy. (We omit *Academic Director Departure* × $year_t$.) We control for Size, Ln(Age), Sales growth, Ln(Tobin's Q), ROA, Leverage, Institutional ownership, Ln(# Analyst), and PhD CEO. More detailed definitions of variables are reported in the Appendix. Firm and year fixed effects are included in all models. All continuous variables are winsorized at 1^{st} and 99^{th} percentiles. The t-statistics reported in parentheses are calculated based on robust standard errors clustered at the firm level. *, **, *** indicate statistic significance at the 10%, 5%, and 1% level, respectively.

	R&D (1)	Ln(Patent) (2)	Ln(Cite) (3)	Ln(Tcw) (4)
Academic Director Departure×$Year_{t-2}$	0.029	-0.227	-0.300	-0.302
	(0.94)	(-0.95)	(-0.55)	(-0.91)
Academic Director Departure×$Year_{t-1}$	-0.005	-0.184	-0.328	-0.292
	(-0.41)	(-0.95)	(-1.05)	(-1.28)
Academic Director Departure×$Year_{t+1}$	0.005	-0.165	-0.858**	-0.496*
	(0.46)	(-0.93)	(-2.04)	(-1.87)
Academic Director Departure×$Year_{t+2}$	0.004	-0.301	-1.127*	-0.503*
	(0.26)	(-1.45)	(-1.89)	(-1.81)
$Year_{t-2}$	-0.158	-2.121***	-0.197	-0.354
	(-0.99)	(-2.77)	(-0.11)	(-0.38)
$Year_{t-1}$	-0.081	-1.111***	-0.145	-0.213
	(-1.06)	(-3.27)	(-0.17)	(-0.47)
$Year_{t+1}$	0.075	1.274***	0.576	0.480
	(0.93)	(3.19)	(0.61)	(0.99)
$Year_{t+2}$	0.143	2.712***	0.999	0.874
	(0.92)	(3.45)	(0.54)	(0.91)
Size	-0.080	0.005	-0.339	0.056
	(-1.48)	(0.03)	(-0.72)	(0.23)
Ln(Age)	0.054	-0.352	0.839	0.136
	(1.35)	(-1.05)	(0.87)	(0.37)
Sales growth	0.001	-0.200	-0.427	-0.166
	(0.06)	(-0.97)	(-1.01)	(-0.71)
Ln(Tobin's Q)	0.005	-0.267	0.220	0.097
	(0.09)	(-0.74)	(0.32)	(0.28)
ROA	0.030	-0.187	-0.499	-0.569
	(0.35)	(-0.38)	(-0.72)	(-1.36)
Leverage	-0.018	-0.197	0.696	0.288
	(-0.33)	(-0.41)	(0.72)	(0.49)
Institutional ownership	-0.031	0.539	2.116**	1.052**
	(-0.52)	(1.44)	(2.43)	(2.09)
Ln(# Analyst)	-0.014	0.187	-0.080	0.091
	(-1.04)	(0.84)	(-0.17)	(0.38)
PhD CEO	0.042	-0.236	-0.530	-0.418
	(1.01)	(-0.58)	(-0.79)	(-0.99)
Firm & Year FE	Yes	Yes	Yes	Yes
N	168	168	168	168
R^2	0.901	0.966	0.932	0.958

Appendix B

Appendices for Chapter 2

A Variable Definitions

Table A1: Variable Definitions

Variable Name	Definition
CEO/Candidate Characteristics	
HIRED	A dummy variable equals one if a individual is hired as CEO by a firm.
CONNECT	A dummy variable equals one if a CEO/candidate shared employment experience with at least one board member of the hiring firm, and zero otherwise. We consider only shared employment experiences in public firms and private firms.
AGE	The age of a CEO candidate by the year of hiring.
MISS DOB	Indicator variable: one if the date of birth of an individual is missing.
GENDER	A dummy variable equals one if an individual is male.
MBA	Indicator variable: one if an individual has an MBA degree.
CEO EXP	A dummy variable equals one if a CEO candidate had CEO experience in the past 10 years before the year of hiring, zero otherwise.
CHAIRMAN EXP	A dummy variable equals one if a CEO candidate had chairman experience in the past 10 years before the year of hiring, zero otherwise.
OTHER EXEC EXP	A dummy variable equals one if a CEO candidate had non-CEO executive experience in the past 10 years before the year of hiring, and zero otherwise.
PUBLIC EXP	A dummy variable equals one if a CEO candidate worked at a public firm in the past 10 years.
# COMPANIES	The total number of companies a CEO candidate has worked for.
# CONNECTIONS	The total number of connections a CEO candidate has built before the year of hiring with board members in companies different from the hiring company.
CEO TALENT	The age at which a CEO candidate is first appointed as a CEO.
Firm Characteristics	
SIZE	Logarithm of 1 plus assets.
# SEGMENTS	Number of business segments.
ROA	Income Before Extraordinary Items (IB) scaled by beginning book assets (AT).
PAST RET	12-month stock return over each fiscal year calculated by compounding monthly CRSP stock returns.
R&D	R&D expenses (XRD) divided by beginning period total assets (AT). Missing values are set to zero.
CAPX	Capital expenditures (CAPX) divided by beginning period total assets (AT).
SG	Total sales (SALE) divided by last period total sales minus 1.
IO	Number of shares held by institutions as a percentage of total firm shares outstanding.
LN(Q)	Book assets (AT) minus the book value of equity plus the market value of equity (ME) divided by book assets (AT) in logarithm.

Name	Definition
OPACITY	For each Fama-French 49 industry with at least 20 firms in a given year, we run five separate regressions for each of year t-4 to year t. In each regression, total current accruals of a firm is regressed on 1) lagged, contemporaneous, and leading cash flows from operations; 2) change in sales; and 3) property, plant, and equipment. Total current accruals equals change in current assets minus change in current liabilities minus change in cash and short-term investments plus change in current debt. For each firm-year, opacity is the standard deviation computed across the residuals of total current accruals from the five industry-year regressions. The definition follows Xu and Yang [111] and Billett and Yu [13].
LEV	Total long-term debt (DLT) plus debt in current liabilities (DLC) scaled by total assets (AT).
DIV	Dividend to common shareholders (DVC) divided by beginning period total assets (AT). If DVC is missing, we use the difference between total dividends (DVT) and preferred dividends (DVP). Missing values are set to zero.
REP	Repurchase of common stock (PRSTKCC) divided by by beginning period total assets (AT). If PRSTKCC is missing, we use the difference between total purchase of stock and purchase of preferred stock (PRSTKC − PRSTKPC). Missing values are set to zero.
VOL	Standard deviation of monthly stock returns over the past 3 fiscal years.
BOARD SIZE	Total number of board members serving on the board of directors in a year.
BOARD IND	Percentage of board members who are independent in a year.
BOARD BUSY	Percentage of board members who hold three or more directorships in a year.
FORCED	Indicator variable: one if a hiring firm fired the previous CEO. The data of forced turnover is from Peters and Wagner [95] and Jenter and Kanaan [68].
TOTAL PAY	Total annual compensation (TDC1 variable from Execucomp) in thousands. Prior to 2006, TDC1 is the sum of *Salary*, *Bonus*, *Other Annual*, *Total Value of Restricted Stock Granted*, *Total Value of Options Granted*, *Long-Term Incentive Payouts*, and *All Other*. Starting in 2006, TDC1 is the sum of *Salary*, *Bonus*, *Non-Equity Incentive Plan Compensation*, *Grant-Date Fair Value of Stock Awards*, *Grant-Date Fair Value of Option Awards*, *Deferred Compensation Earnings Reported as Compensation*, and *Other Compensation*.
EXCESS PAY	The residual from a regression of CEO TOTAL PAY on firm size (SIZE), industry fixed effects (3-digit SIC), and the interaction of the two, estimated using all CEOs in ExecuComp from 2000 to 2018.
M&A Characteristics	
STOCK DEAL	Indicator variable: one for deals financed partially or fully with stock, zero otherwise.
DIVERSIFYING ACQUISITION	Indicator variable: one if acquirer and target do not share the same 2-digit SIC code, zero otherwise.
RELATIVE DEAL SIZE	Deal value divided by acquirer's market value of equity.
MISS RELATIVE DEAL SIZE	Indicator variable: one if RELATIVE DEAL SIZE is missing, zero otherwise.
TENDER OFFER	Indicator variable: one for tender offers, zero otherwise.
HOSTILE	Indicator variable: one if the bid is hostile, zero otherwise.
TOEHOLD	Indicator variable: one if the acquirer owns a non-zero percentage of target's stock prior to announcement date, zero otherwise.
RUN-UP	Buy-and-hold abnormal return (BHAR) during the 200 trading days ending two months before each M&A announcement date with CRSP value-weighted return as the market index.

B Summary Statistics

Table B1: Summary Statistics

This table presents summary statistics of firm characteristics in the diff-in-diff sample for the period 2000-2016. Namely, for each new CEO appointment event, we include 3 fiscal years before and 2 fiscal years after the fiscal year of the NEW CEO joining the company. We report available observations, mean (Mean), standard deviations (S. D.), 25 percentile (P25), median (P50), and 75th percentile (P75). All statistics are based on pooled data.

	#Obs	Mean	S. D.	P25	P50	P75
ROA	3,996	0.020	0.141	-0.004	0.034	0.076
LN(Q)	3,995	0.980	0.326	0.741	0.892	1.118
SIZE	3,984	7.478	1.629	6.327	7.355	8.473
CAPX	3,937	0.051	0.066	0.016	0.032	0.062
R&D	3,985	0.038	0.076	0.000	0.002	0.045
DIV	3,985	0.012	0.023	0.000	0.000	0.014
VOL	3,986	0.030	0.020	0.020	0.027	0.036
BOARD SIZE	3,573	9.114	2.186	8.000	9.000	10.000
BOARD IND	3,573	0.774	0.148	0.714	0.818	0.889
BOARD BUSY	3,561	0.332	0.326	0.125	0.286	0.455

Bibliography

[1] Margaret A. Abernethy, Yu Flora Kuang, and Bo Qin. The relation between strategy, ceo selection, and firm performance. *Contemporary Accounting Research*, 36(3):1575–1606, 2019.

[2] Renée B. Adams, Heitor Almeida, and Daniel Ferreira. Powerful CEOs and their impact on corporate performance. *Review of Financial Studies*, 18(4):1403–1432, 2005.

[3] Renée B. Adams, Ali C. Akyol, and Patrick Verwijmeren. Director skill sets. *Journal of Financial Economics*, 130:641–662, 2018.

[4] Renée B. Adams and Daniel Ferreira. Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, 94:291–309, 2009.

[5] Kenneth R. Ahern and Amy K. Dittmar. The Changing of the Boards: The Impact on Firm Valuation of Mandated Female Board Representation *. *The Quarterly Journal of Economics*, 127(1):137–197, 2012.

[6] Manning Alan. Chapter 11 - imperfect competition in the labor market. volume 4 of *Handbook of Labor Economics*, pages 973–1041. Elsevier, 2011.

[7] Ana M. Albuquerque, Gus De Franco, and Rodrigo S. Verdi. Peer choice in ceo compensation. *Journal of Financial Economics*, 108(1):160–181, 2013.

[8] Julian Atanassov. Do hostile takeovers stifle innovation? evidence from antitakeover legislation and corporate patenting. *The Journal of Finance*, 68:1097–1131, 2013.

[9] Eli Bartov, Dan Givoly, and Carla Hayn. The rewards to meeting or beating earnings expectations. *Journal of Accounting and Economics*, 33(2):173–204, 2002.

[10] Lucian Bebchuk and Jesse Fried. *Pay without Performance - The Unfulfilled Promise of Executive Compensation.* International series of monographs on physics. Harvard University Press, 2006.

[11] Jan Bena and Kai Li. Corporate innovations and mergers and acquisitions. *The Journal of Finance*, 69:1923–1960, 2014.

[12] Marianne Bertrand, Sandra E Black, Sissel Jensen, and Adriana Lleras-Muney. Breaking the Glass Ceiling? The Effect of Board Quotas on Female Labour Market Outcomes in Norway. *The Review of Economic Studies*, 86(1):191–239, 2018.

[13] Matthew T. Billett and Miaomiao Yu. Asymmetric information, financial reporting, and open-market share repurchases. *Journal of Financial and Quantitative Analysis*, 51(4):1165–1192, 2016.

[14] Agyenim Boateng, Wang Qian, and Yang Tianle. Cross-border m&as by chinese firms: An analysis of strategic motives and performance. *Thunderbird International Business Review*, 50(4):259–270, 2008.

[15] Rodney D. Boehme, Bartley R. Danielsen, Praveen Kumar, and Sorin M. Sorescu. Idiosyncratic risk and the cross-section of stock returns: Merton (1987) meets miller (1977). *Journal of Financial Markets*, 12(3):438–468, 2009.

[16] James A. Brickley, Jeffrey L. Coles, and Rory L. Terry. Outside directors and the adoption of poison pills. *Journal of Financial Economics*, 35(3):371–390, 1994.

[17] Arturo Bris and Christos Cabolis. The value of investor protection: Firm evidence from cross-border mergers. *The Review of Financial Studies*, 21(2):605–648, 2008.

[18] Robert Bushman, Zhonglan Dai, and Xue Wang. Risk and ceo turnover. *Journal of Financial Economics*, 96(3):381–398, 2010.

[19] Ye Cai and Merih Sevilir. Board Connections and M&A Transactions. *Journal of Financial Economics*, 103(2):327–349, 2012.

[20] Saeyoung Chang. Takeovers of privately held targets, methods of payment, and bidder returns. *The Journal of Finance*, 53(2):773–784, 1998.

[21] Lauren Cohen, Andrea Frazzini, and Christopher Malloy. The Small World of Investing: Board Connections and Mutual Fund Returns. *Journal of Political Economy*, 116(5): 951–979, 2008.

[22] Lauren Cohen, Andrea Frazzini, and Christopher Malloy. Sell-Side School Ties. *Journal of Finance*, 65(4):1409–1437, 2010.

[23] Jeffrey L. Coles, Naveen D. Daniel, and Lalitha Naveen. Managerial incentives and risk-taking. *Journal of Financial Economics*, 79:431–468, 2006.

[24] Jeffrey L. Coles, Naveen D. Daniel, and Lalitha Naveen. Co-opted boards. *Review of Financial Studies*, 27:1751–1796, 2014.

[25] James F. Cotter, Anil Shivdasani, and Marc Zenner. Do independent directors enhance target shareholder wealth during tender offers? *Journal of Financial Economics*, 43 (2):195–218, 1997.

[26] K. Cremers and Yaniv Grinstein. Does the Market for CEO Talent Explain Controversial CEO Pay Practices. *Review of Finance*, 18:921–960, 2014.

[27] Martijn Cremers and Yaniv Grinstein. The market for ceo talent: Implications for ceo compensation. *Unpublished Working Paper*, 2008.

[28] C. Custódio, M. Ferreira, and Pedro Matos. Generalists versus specialists: Lifetime work experience and chief executive officer pay. *Journal of Financial Economics*, 108: 471–492, 2013.

[29] Cláudia Custódio and Daniel Metzger. Financial expert CEOs: CEO's work experience and firm's financial policies. *Journal of Financial Economics*, (1):125–154, 2014.

[30] P. Cziráki and Dirk Jenter. The Market for CEOs. *Working Paper*, 2021.

[31] Nishant Dass, Omesh Kini, Vikram Nanda, Bunyamin Onal, and Jun Wang. Board expertise: Do directors from related industries help bridge the information gap? *Review of Financial Studies*, 27:1533–1592, 2014.

[32] Deepak K. Datta and James P. Guthrie. Executive succession: Organizational antecedents of ceo characteristics. *Strategic Management Journal*, 15(7):569–577, 1994.

[33] Wolfgang Drobetz, Felix von Meyerinck, David Oesch, and Markus Schmid. Is director industry experience a corporate governance mechanism? *SSRN Electronic Journal*, 2013.

[34] Wolfgang Drobetz, Felix von Meyerinck, David Oesch, and Markus Schmid. Industry expert directors. *Journal of Banking and Finance*, 92:195–215, 2018.

[35] Ran Duchin, John G. Matsusaka, and Oguzhan Ozbas. When are outside directors effective? *Journal of Financial Economics*, 96(2):195–214, 2010.

[36] Andrea L. Eisfeldt and Camelia M. Kuhnen. Ceo turnover in a competitive assignment framework. *Journal of Financial Economics*, 109:351–372, 2013.

[37] Rwan El-Khatib, Kathy Fogel, and Tomas Jandik. Ceo network centrality and merger performance. *Journal of Financial Economics*, 116(2):349–382, 2015.

[38] Joseph Engelberg, Pengjie Gao, and Christopher A. Parsons. Friends with money. *Journal of Financial Economics*, 103(1):169–188, 2012.

[39] Isil Erel, Rose C. Liao, and Michael S. Weisbach. Determinants of cross-border mergers and acquisitions. *The Journal of Finance*, 67(3):1045–1082, 2012.

[40] Mara Faccio, John J. McConnell, and David Stolin. Returns to acquirers of listed and unlisted targets. *Journal of Financial and Quantitative Analysis*, 41(1):197–220, 2006.

[41] Rüdiger Fahlenbrach, Angie Low, and René M. Stulz. Why do firms appoint ceos as outside directors? *Journal of Financial Economics*, 97(1):12–32, 2010.

[42] Olubunmi Faleye, Rani Hoitash, and Udi Hoitash. Industry expertise on corporate boards. *Review of Quantitative Finance and Accounting*, 50:441–479, 2018.

[43] Eugene F. Fama and Michael C. Jensen. Separation of ownership and control. *The Journal of Law & Economics*, 26(2):301–325, 1983.

[44] C. Edward Fee, Charles J. Hadlock, and Joshua R. Pierce. Managers with and without Style: Evidence Using Exogenous Variation. *The Review of Financial Studies*, 26(3): 567–601, 2013.

[45] Eliezer M. Fich. Are some outside directors better than others? evidence from director appointments by fortune 1000 firms. *Journal of Business*, 78:1943–1971, 2005.

[46] Cesare Fracassi and Geoffrey Tate. External Networking and Internal Firm Governance. *Journal of Finance*, 67(1):153–194, 2012.

[47] Bill Francis, Iftekhar Hasan, and Qiang Wu. Professors in the boardroom and their impact on corporate governance and firm performance. *Financial Management*, 44(3): 547–581, 2015.

[48] Kathleen Fuller, Jeffry Netter, and Mike Stegemoller. What do returns to acquiring firms tell us? evidence from firms that make many acquisitions. *The Journal of Finance*, 57(4):1763–1793, 2002.

[49] Xavier Gabaix and Augustin Landier. Why Has CEO Pay Increased So Much. *Quarterly Journal of Economics*, 123(1):49–100, 2008.

[50] Robert Gibbons and Kevin J. Murphy. Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence. *Journal of Political Economy*, 100(3):468–505, 1992.

[51] Eitan Goldman, Jörg Rocholl, and Jongil So. Politically Connected Boards of Directors and the Allocation of Procurement Contracts. *Review of Finance*, 17(5):1617–1648, 2013.

[52] Radhakrishnan Gopalan, Todd Milbourn, Fenghua Song, and Anjan V. Thakor. Duration of executive compensation. *The Journal of Finance*, 69(6):2777–2817, 2014.

[53] John R. Graham, Campbell R. Harvey, and Shiva Rajgopal. The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, 40(1):3–73, 2005.

[54] Mark Granovetter. The impact of social structure on economic outcomes. *Journal of Economic Perspectives*, 19(1):33–50, 2005.

[55] A. Burak Güner, Ulrike Malmendier, and Geoffrey Tate. Financial expertise of directors. *Journal of Financial Economics*, 88:323–354, 2008.

[56] Bronwyn H. Hall, Adam Jaffe, and Manuel Trajtenberg. Market value and patent citations. *The RAND Journal of Economics*, 36(1):16–38, 2005.

[57] Kevin F. Hallock. Reciprocally Interlocking Boards of Directors and Executive Compensation. *Journal of Financial and Quantitative Analysis*, 32:331–344, 1997.

[58] Eben Harrell. Succession planning: What the research says. *Harvard Business Review*, 2016.

[59] Milton Harris and Artur Raviv. A Theory of Board Control and Size. *The Review of Financial Studies*, 21(4):1797–1832, 2006.

[60] Roie Hauser. Busy directors and firm performance: Evidence from mergers. *Journal of Financial Economics*, 128(1):16–37, 2018.

[61] Zhaozhao He and David Hirshleifer. The exploratory mindset and corporate innovation. *Journal of Financial and Quantitative Analysis (forthcoming)*, 2020.

[62] Yael V. Hochberg, Alexander Ljungqvist, and Yang Lu. Whom You Know Matters: Venture Capital Networks and Investment Performance. *Journal of Finance*, 62(1): 251–301, 2007.

[63] Byoung-Hyoun Hwang and Seoyoung Kim. It pays to have friends. *Journal of Financial Economics*, 93(1):138 – 158, 2009.

[64] Paul Ingram and Peter W. Roberts. Friendships Among Competitors in the Sydney Hotel Industry. *American Journal of Sociology*, 106(2):387–423, 2000.

[65] Joy Ishii and Yuhai Xuan. Acquirer-Target Social Ties and Merger Outcomes. *Journal of Financial Economics*, 112(3):344–363, 2014.

[66] Michael C. Jensen. The modern industrial revolution, exit, and the failure of internal control systems. *The Journal of Finance*, 48:831–880, 1993.

[67] Michael C Jensen and William H Meckling. Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3:305–360, 1976.

[68] Dirk Jenter and Fadi Kanaan. Ceo turnover and relative performance evaluation. *The Journal of Finance*, 70:2155–2184, 2015.

[69] Boyan Jovanovic. Job Matching and the Theory of Turnover. *Journal of Political Economy*, 87(5):972–990, 1979.

[70] Hae Won (Henny) Jung and Ajay Subramanian. Ceo talent, ceo compensation, and product market competition. *Journal of Financial Economics*, 125(1):48–71, 2017.

[71] Shinwoo Kang, E Han Kim, and Yao Lu. Does Independent Directors' CEO Experience Matter? *Review of Finance*, 22(3):905–949, 2017.

[72] Steveb N. Kaplan, Mark M. Klebanov, and Morten Sorensen. Which ceo characteristics and abilities matter? *The Journal of Finance*, 67(3):973–1007, 2012.

[73] Steven N. Kaplan and Morten Sorensen. Are ceos different? *The Journal of Finance*, 76(4):1773–1811, 2021.

[74] Vikramaditya Khanna, E. Han Kim, and Yao Lu. Ceo connectedness and corporate fraud. *The Journal of Finance*, 70(3):1203–1252, 2015.

[75] Daehyun Kim and Laura T. Starks. Gender diversity on corporate boards: Do women contribute unique skills? *American Economic Review*, 106:267–271, 2016.

[76] Leonid Kogan, Dimitris Papanikolaou, Amit Seru, and Noah Stoffman. Technological Innovation, Resource Allocation, and Growth*. *The Quarterly Journal of Economics*, 132(2):665–712, 2017.

[77] S.P. Kothari, Andrew J. Leone, and Charles E. Wasley. Performance matched discretionary accrual measures. *Journal of Accounting and Economics*, 39(1):163–197, 2005.

[78] Francis Kramarz and David Thesmar. Social networks in the boardroom. *Journal of the European Economic Association*, 11(4):780–807, 2013.

[79] Jayanthi Krishnan, Yuan Wen, and Wanli Zhao. Legal expertise on corporate audit committees and financial reporting quality. *The Accounting Review*, 86(6):2099–2130, 2011.

[80] David F. Larcker, Scott A. Richardson, A. Seary, and A. Tuna. Back Door Links between Directors and Executive Compensation. *Working Paper*, 2005.

[81] David F. Larcker, Eric C. So, and Charles C.Y. Wang. Boardroom Centrality and Firm Performance. *Journal of Accounting and Economics*, 55(2-3):225–250, 2013.

[82] Zhe Li, Ping Wang, and Jing-Ming Kuo. Cross-border mergers and acquisitions and corporate social responsibility: Evidence from chinese listed firms. *Working Paper*, 2019.

[83] Yun Liu. Outside options and ceo turnover: The network effect. *Journal of Corporate Finance*, 28:201–217, 2014. Inside the Board Room.

[84] Gustavo Manso. Motivating innovation. *Journal of Finance*, 66:1823–1860, 2011.

[85] Ronald W. Masulis, Cong Wang, and Fei Xie. Globalizing the boardroom—the effects of foreign directors on corporate governance and firm performance. *Journal of Accounting and Economics*, 53(3):527–554, 2012.

[86] David Mayers, Anil Shivdasani, and Clifford W. Smith. Board composition and corporate control: Evidence from the insurance industry. *The Journal of Business*, 70(1): 33–62, 1997.

[87] James D. Montgomery. Social networks and labor-market outcomes: Toward an economic analysis. *The American Economic Review*, 81(5):1408–1418, 1991.

[88] Lalitha Naveen. Organizational Complexity and Succession Planning. *Journal of Financial and Quantitative Analysis*, 41:661–683, 2006.

[89] Bang Dang Nguyen. Does the Rolodex Matter? Corporate Elite's Small World and the Effectiveness of Boards of Directors. *Management Science*, 58(2):236–252, 2012.

[90] Bang Dang Nguyen and Kasper Meisner Nielsen. The value of independent directors: Evidence from sudden deaths. *Journal of Financial Economics*, 98(3):550–567, 2010.

[91] Yihui Pan. The determinants and impact of executive-firm matches. *Management Science*, 63(1):185–200, 2017.

[92] Robert Parrino. Ceo turnover and outside succession a cross-sectional analysis. *Journal of Financial Economics*, 46(2):165–197, 1997.

[93] Robert Parrino and Raji Srinivasan. Ceos with marketing backgrounds: When are they appointed and how well do their firms perform? 2011.

[94] Donna L. Paul. Board composition and corrective action: Evidence from corporate responses to bad acquisition bids. *The Journal of Financial and Quantitative Analysis*, 42(3):759–783, 2007.

[95] Florian S. Peters and Alexander F. Wagner. The executive turnover risk premium. *The Journal of Finance*, 69:1529–1563, 2014.

[96] Everett Rogers and Dilip Bhowmik. Homophily-Heterophily : Relational Concepts for Communication Research. *Public Opinion Quarterly*, 34(4):523–538, 1971.

[97] Sherwin Rosen. Authority, Control, and the Distribution of Earnings. *The Bell Journalf of Economics*, 13(2):311–323, 1982.

[98] Stefano Rossi and Paolo Volpin. 3 - the governance motive in cross-border mergers and acquisitions. In Greg N. Gregoriou and Luc Renneboog, editors, *Corporate Governance and Regulatory Impact on Mergers and Acquisitions*, Quantitative Finance, pages 43–69. Academic Press, Boston, 2007.

[99] Sugata Roychowdhury. Earnings management through real activities manipulation. *Journal of Accounting and Economics*, 42(3):335–370, 2006.

[100] Richard M Ryan and Edward L Deci. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55: 68–78, 2000.

[101] Michael Sattinger. Assignment Models of the Distribution of Earnings. *Journal of Economic Literature*, 31(2):831–880, 1993.

[102] Breno Schmidt. Costs and Benefits of Friendly Boards During Mergers and Acquisitions. *Journal of Financial Economics*, 117(2):424–447, 2015.

[103] Jeremy C. Stein. Takeover threats and managerial myopia. *Journal of Political Economy*, 96:61–80, 1988.

[104] Marko Terviö. The Difference That CEOs Make: An Assignment Model Approach. *American Economic Review*, 98(3):642–668, 2008.

[105] Brian Uzzi. The Sources and Consequences of Embeddedness for the Economic Performance of Organizations : The Network Effect. *American Sociological Review*, 61 (4):674–698, 1996.

[106] Joanna (Xiaoyu) Wang. Board connections and ceo successions. *Working Paper*, 2021.

[107] Michael S. Weisbach. Outside directors and ceo turnover. *Journal of Financial Economics*, 20:431–460, 1988.

[108] Joshua T. White, Tracie Woidtke, Harold A. Black, and Robert L. Schweitzer. Appointments of academic directors. *Journal of Corporate Finance*, 28(C):135–151, 2014.

[109] Dirk U. Wulff, Thomas T. Hills, and Ralph Hertwig. How short- and long-run aspirations impact search and choice in decisions from experience. *Cognition*, 144:29–37, 2015.

[110] Emma Qianying Xu. Cross-border merger waves. *Journal of Corporate Finance*, 46: 207–231, 2017.

[111] Jin Xu and Jun Yang. Golden hellos: Signing bonuses for new top executives. *Journal of Financial Economics*, 122(1):175–195, 2016.

[112] Scott E. Yonker. Geography and the market for ceos. *Management Science*, 63(3): 609–630, 2017.