The impact of subordinate executives' confidence and ability on corporate risk-taking

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Abstract

We document that subordinate executives' confidence and ability (*SubEx_ConAbl*) to monitor CEOs' actions increase corporate risk-taking. We further find that this positive impact channels through the firm's investment and financing activities, such as investments in capital expenditures, R&D, intangible assets, and advertising expenses and financing via cash, equity, and leverage. These activities account for approximately 36% of return on assets volatility and 24% of cash flow volatility. Additionally, we show that the effect of *SubEx_ConAbl* is more pronounced in competitive and complex business environments. However, the presence of highly experienced but older executives and more powerful and overconfident CEOs undermines the effect. Our results are robust to endogeneity concerns.

JEL Codes: *G30; G32; M12*

Keywords: *subordinate executives; confidence and ability; corporate risk-taking; investment and financing decisions*

"Great things in business are never done by one person. They are done by a team of people."

–Steve Jobs
Co-founder of Apple Inc.

"There are four ingredients in true leadership: brains, soul, heart, and good nerves."

–Klaus Schwab
Founder & Executive Chairman of World Economic Forum

1. Introduction

The extant corporate finance literature on the CEOs or all executives generally suggests that managerial confidence and ability are likely to influence corporate decision-making (see e.g., Malmendier and Tate, 2005 and 2008; Hirshleifer et al., 2012; Chen et al., 2015; Yung and Chen, 2018; etc.). Albeit the importance is high for overall corporate functionality, we have little specific evidence on how the confidence and ability of the key subordinate executives (i.e., ranking next in order to the CEO but above all other managers in a firm - holding positions like CFO, COO, CTO, etc.) may contribute to long-term firm performance and impact corporate decision-making. So far, Cheng et al. (2016) investigated the impact of key subordinate executives' ability on corporate real earnings management, and Jain et al. (2016) explored how their perceived horizon (an indirect measure of subordinate executives' confidence relative to CEO confidence) may affect stock market liquidity. In a recent study, Mekhaimer et al. (2022) document that key subordinate executives' longer horizon (measured as the distance from the typical retirement age) incentivizes the firm to increase total and idiosyncratic risks by increasing investments and decreasing dividends. We complement this stream of the emerging literature and fill a critical research gap by examining the impact of subordinate

executives' confidence and ability (hereafter *SubEx_ConAbl)* on corporate risk-taking (and relatedly on corporate investment and financing policies).[1]

Investigating *SubEx_ConAbl* to monitor CEOs' activities is crucial because CEOs do not always act faithfully, although they are supposed to work on behalf of the shareholders and make decisions that maximize the firm value (Modigliani and Miller, 1958; Jensen and Meckling, 1976; Pruzan, 1998; Pearce et al., 2007; Ravenscroft and Williams, 2009; Acharya et al., 2011; Petty et al., 2015). To control the CEO's self-interested activities, the board of directors monitors the CEO on behalf of shareholders. However, Bebchuk and Fried (2004) find that boards are sometimes generous, and shareholders have little control over the board. In such cases, it is more important that the subordinate executives build a strong resistance to the CEO's short-termism by impacting corporate investment and financing decisions (Laverty, 1996; Marginson and McAulay, 2008; Cheng et al., 2016; Wang et al., 2019). It becomes possible if the subordinate executives have confidence in the firm's long-term performance and ability to constrain CEOs' self-interested actions. Furthermore, since these special executives possess firm and industry-specific knowledge, have superior problem-solving skills, and are experienced and engaged in day-to-day operations, they are not only confident but also capable of closely monitoring the CEO (Cheng et al., 2016; Jain et al., 2016; Mekhaimer et al., 2022). Since the CEO cares about job security, she/he also needs subordinate executives' efforts to generate future cash flow. In such a situation, bottom-up internal governance can be the most effective because both subordinate executives and the CEO contribute to the firm cash flow generation (Acharya et al.,

[1] Although horizon measures *"incentive,"* it hardly measures *"relative confidence and/or ability."* If the subordinate executives are not confident about the firm's long-term success, they might not exert fruitful effort even though they are being compensated for doing so. Likewise, if the executives cannot constrain the CEO's short-term myopic behavior, it becomes harder to implement long-term corporate policies. Therefore, it is imperative that research is conducted on how *"relative confidence and ability"* may impact corporate risk-taking & firm value as the impact of horizon tells us only part of a much bigger story. By examining the relationship between *SubEx_ConAbl* and corporate risk-taking, this study not only augments the findings in Mekhaimer et al. (2022) but also plays an integral part in closing the loop between bottom-up internal governance and corporate risk-taking.

2011; Landier et al., 2013). Moreover, if a firm increases investment in risky projects in pursuit of higher long-term value and growth, its return on assets and cash flows are likely to become volatile (Minton and Schrand, 1999; Jayaraman, 2008; Bollerslev et al., 2015). Since subordinate executives care more about long-term value, they prefer risky but value-enhancing long-term investments (Cheng et al., 2016; Mekhaimer et al., 2022). We, therefore, expect a positive association between *SubEx_ConAbl* and firm risk-taking.

To test this prediction, we conduct a panel study of Standard & Poor's (S&P) 1500 firms from 2001 to 2019. Consistent with our expectation, we find that *SubEx_ConAbl* significantly influences corporate risk-taking behavior proxied by return on assets volatility (ROA_Vol) and cash flow volatility (CF_Vol). Our findings are complementary and incremental to the recent study by Mekhaimer et al. (2022) from at least two perspectives. *First*, return on asset volatility and cash-flow volatility are two commonly used long-term corporate risk-taking proxies [than the idiosyncratic volatility and total volatility that Mekhaimer et al. (2022) use in their study] that deserve further exploration in our context (see e.g., Minton and Schrand, 1999; Jayaraman, 2008; Kini and Williams, 2012). *Second*, we find evidence supporting our earlier argument that the root of executive horizon becoming effective in monitoring CEO actions lies primarily in the executives' confidence and ability. Specifically, we show that executive horizon can play a significant role in corporate risk-taking only with higher *SubEx_ConAbl.*

However, a firm's investment and/or financing decisions could influence an increase in corporate risk-taking (John et al., 1994; Coles et al., 2006; John et al., 2008; King and Wen, 2011; Boubakri et al., 2013; Kuang and Qin, 2013; Koirala et al., 2020; Chen et al., 2021). If the riskiness in investment decisions (that are usually value-enhancing) dominates the riskiness in financing decisions, the shareholder value should increase (Leland, 2007; Bauguess and Stegemoller, 2008; Hackbarth,

2008; Adams and Mansi, 2009; Surroca et al., 2020; Zhu et al., 2021). Relatedly, if riskiness in financing decisions dominates investment decisions, firms may experience mixed consequences. For example, raising less costly debt on easy terms will help firms finance risky investment projects. Moreover, if firms increase leverage significantly, it might increase bankruptcy risks. Alternatively, firms holding excessive liquid assets might lead to CEO entrenchment and empire building. Therefore, examining how riskiness for firms with better *SubEx_ConAbl* increases is crucial. We focus on corporate investment and financing policies to explore potential channels. Our results show that firms with higher *SubEx_ConAbl* increase investment in less risky projects such as capital expenditure and more risky projects such as R&D, intangible assets, and advertising. In addition, we find that these firms reduce net leverage and increase equity issuance and cash holdings, most likely to finance the increased investments. Our investigation finds that approximately 24.32% (28.77%) of return on assets volatility and 20.33% (15.88%) of cash flow volatility could be attributable to investment (financing) policies. The combination of all investment and financing decisions contributes approximately 41% of ROA volatility and 28% of cash flow volatility.

Our empirical model adjusts for industry and time heterogeneities (as we include industry and year dummies) and includes several influential factors affecting corporate risk-taking as controls. Additionally, we investigate channeling effects, including the financing and investment factors in the model. Still, endogeneity could be a vital issue in corporate governance studies like ours. Therefore, we further address the potential endogeneity issues by conducting the instrumental variable test, the difference-in-difference (DiD) test, and rerunning the model with the firm fixed effect. Moreover, we conduct an Oster (2019) test to ensure that our findings do not suffer from omitted variable bias. Following extant literature, we also check for sample selection bias, non-linearity, and co-variation concerns by rerunning our baseline model with Propensity Score Matching (PSM) and Entropy Balancing (EB) samples. Notably, in all cases, our primary findings hold. Finally, we further check for

the robustness of our findings by employing different proxies of internal governance (as our main independent variable) and corporate risk-taking (as our main dependent variable) and find qualitatively similar and robust results to these alternative measures.

We next attempt to dissect the effectiveness of *SubEx_ConAbl* in corporate risk-taking from several perspectives borrowed from extant executive literature. *First*, the theoretical framework of Acharya et al. (2011) posits that external governance can complement internal governance and mitigate agency problems by improving efficiency (also see John and Senbet, 1998; Fan and Wong, 2005; Filatotchev and Nakajima, 2010; Chen et al., 2012; Misangyi and Acharya, 2014; Shi et al., 2017; Jiang and Kim, 2020). Accordingly, we investigate whether firms with strong external governance and operational complexity benefit more when subordinate executives are more confident and capable of implementing long-term business policies. Using product market competition measured by Herfindahl-Hirschman Index (HHI) in the literature as a proxy for external governance[2], we document the superior impact of *SubEx_ConAbl* on risk-taking, investment, and financing policies with better external governance. *Second*, Graham et al. (2015) argue that a CEO delegates her/his decisions to subordinate executives when a firm's operation is complex (also see Kelly et al., 2000; Grabner and Speckbacher, 2016; Malikov et al., 2021). Intuitively, if the top executives are more confidence and capable, they can capitalize on the responsibility to improve firm performance. Our evidence consistently shows that firms with better *SubEx_ConAbl* in complex business settings improve calculative risk-taking by strengthening a firm's business and finance policies. *Third*, subordinate executives' effort and ability should increase with their experience (Narayanan, 1985; Casamatta, 2003; Kor, 2003; Libby et al., 2004; Agrawal et al., 2006; Manolova et al., 2007; Yeaton and Hall, 2008; Demerjian et al., 2012; Ramiah et al., 2016). However, their perceived horizon or confidence about

[2] See, for example, Cetorelli and Strahan, 2006; Hoberg and Phillips, 2010; Kim and Lu, 2011; Cipollini and Fiordelisi, 2012; Abedifar et al., 2016; Anadu et al., 2020; Azar et al., 2022.

the firms' long-term success may or may not increase since age also increases with experience. Mekhaimer et al. (2022) find that when executives' horizon is more prolonged, i.e., when the executives are younger, firms increase risk by increasing investments. In other words, firms with older executives may experience the opposite effect. We find consistent results with such a notion. Specifically, our findings show that the magnitude of risk-taking decreases with experience mainly due to the insignificant effect on investment activities. Overall, this cross-sectional outcome of our study suggests that as executives get older with experience, their confidence and effort might be less pronounced than when they are younger.

In our additional analyses, we examine two related perspectives relevant to our argument in this study. *First*, we investigate whether risk-taking leads to higher firm value and enhances innovation efficiencies as the extant literature finds that such factors are indispensable to corporate risk-taking and often work as the motivational forces for being risk-taker[3]. If the firms with strong *SubEx_ConAbl* take excessive risk, it will reduce the firm value. Notably, our investigation reveals that firm value, gross margin as well as innovation efficiencies (proxied by several indicators such as patent, citation, and patent value) increase with stronger *SubEx_ConAbl*. *Second*, Acharya et al. (2011), among others, argue that if CEO's contribution dominates, she/he does not need to incentivize the subordinates by limiting her/his capture of cash flow. Conversely, if a subordinate executive's contribution dominates, she/he has little incentive to learn because learning will be of little use when he becomes the next CEO. Therefore, when one dominates the other, the internal governance or effectiveness of *SubEx_ConAbl* breaks down. For example, CEO overconfidence or excessive power can render *SubEx_ConAbl* ineffective because powerful or overconfident CEOs are typically self-serving and might not take input from subordinate executives (Billett and Qian, 2008; Libby and Rennekamp,

[3] See, for example, March and Shapira, 1987; Holmstrom, 1989; Galasso and Simcoe, 2011; Coles et al., 2006; Armstrong and Vashishtha, 2012; García-Granero et al., 2015; Faccio et al., 2016; Harjoto and Laksmana, 2018.

2012). Overconfident CEOs might overestimate the true potential of the projects, while powerful CEOs may be interested in building an empire, expropriating firm assets for personal benefits, and taking risks that serve their own interests (Hope and Thomas, 2008; Baldenius et al., 2014). When we examine the impact of CEO overconfidence and CEO power by interacting the overconfidence dummy and CEO power measure respectively with *SubEx_ConAbl*, we find evidence that these CEO characteristics undermine its positive effect.

Our study contributes to the literature on several important fronts. *First*, our findings complement the only handful of existing corporate studies dedicated to the key subordinate executives, namely Cheng et al. (2016), Jain et al. (2016), and Mekhaimer et al. (2022). *Second*, prior literature on agency theory shows that managers play safe and avoid taking risks due to their career concerns, even though the increased risk is associated with a long-term firm value (Amihud and Lev, 1981; Gormley and Matsa, 2016; Hirshleifer and Thakor, 1992). As a solution, Gormley and Matsa (2016) argue that corporate boards must restructure their governance style to motivate managers to take risks. In addition, John et al. (2008) show that strong external governance can force managers to take risks necessary to increase shareholder wealth. We add to this debate by showing that subordinate executives' confidence and ability to monitor the CEO's actions can enforce corporate risk-taking behavior and increase firm value. *Third*, we provide empirical evidence supporting the theoretical predictions of Acharya et al. (2011) that external governance complements the bottom-up internal governance and improves risk-taking. Specifically, we show that internal governance originating from subordinate executives' confidence and ability can significantly improve investments in risky projects such as intangibles and advertising expenses when external governance is strong. *Fourth*, we add to the literature that shows that CEO overconfidence and ability contribute to the firm's greater innovation efficiency (Chen et al., 2015; Hirshleifer et al., 2012; Yung and Chen, 2018). We provide supportive evidence that subordinate top executives' confidence and ability also matter in improving innovative

efficiency. *Fifth*, our study adds to the voluminous corporate governance literature on corporate risk-taking (see e.g., Wright et al., 2007; John et al., 2008; Bargeron et al., 2010; Dey, 2010; Acharya et al, 2011b; Faccio et al., 2011; Boubakri et al., 2013; Bruno and Shin, 2014; Ljungqvist et al., 2017; Langenmayr and Lester, 2018; Armstrong et al., 2019; Gopalan et al., 2021; Do et al., 2022; etc.). Last but not least, our study contributes to the literature on the importance of bottom-up governance (Acharya et al., 2011; Cheng et al., 2016; Jain et al., 2016; Landier et al., 2012; Xie et al., 2020). While Landier et al. (2012) find that bottom-up internal governance is associated with lower firm profitability and shareholder returns, we find evidence that bottom-up internal governance formed by top subordinate executives' confidence and ability improves firm value. We believe that the sharp contrast of the findings is due to how internal governance is measured.[4]

We organize the remainder of the article as follows. First, we review the extant literature and accordingly develop the hypothesis in Section 2. Next, we describe the sample construction and methodology in Section 3. Finally, we discuss the results in Section 4 and conclude in Section 5.

2. Literature review and hypothesis development

The literature on corporate risk-taking is relatively mainstream and mature. Numerous studies have offered possible determinants of corporate risk-taking ranging from internal to external factors. Some of such factors include corporate governance (John et al., 2008; Koirala et al., 2020), creditor rights (Acharya et al., 2011b), shareholder diversification (Faccio et al., 2011; Bauguess et al., 2012),

[4] Landier et al. (2012) consider the fraction of top executives hired before the appointment of CEO as their internal governance. However, they do not consider the executives' confidence and pay ratio, potentially creating at least two issues. *First*, some executives hired before the current CEO might have less confidence and not oppose the CEO's decisions even though they are not dependent executives (i.e., executives hired after the current CEO). *Second*, some dependent executives might have a longer perceived horizon because they are more confident than the CEO. These two scenarios could also be factual for any executive regardless of the hiring period. Moreover, even though the dependent executives might not oppose it initially, their compensation structure and tournament incentives might motivate them, in the long run, to create a strong influence on CEOs' decisions, again regardless of the hiring period.

state and foreign ownership (Boubakri et al., 2013), corporate culture (Li et al., 2013), globalization (Bruno and Shin, 2014), taxation (Ljungqvist et al., 2017; Langenmayr and Lester, 2018; Armstrong et al., 2019), political institutions, connectedness, and corruption (Boubakri et al., 2013b; Khieu et al., 2022), macro-economic conditions (Gupta and Krishnamurti, 2018); changes in regulations (Bargeron et al., 2010; Dey, 2010), and managerial characteristics and incentives (Wright et al., 2007; Faccio et al., 2016; Ferris et al., 2017; Yost, 2018; Chu et al., 2020; Gopalan et al., 2021; Do et al., 2022).

On the other hand, literature on managerial ability and confidence, often focusing on CEOs, is also prominent. This stream of literature often explores the role of managerial ability and (over)confidence in various corporate decisions and outcomes, such as abnormal market return (Hayes and Schaefer, 1999), valuation (Holcomb et al., 2009; Devers et al., 2013; Mishra, 2014; De Franco et al., 2017; Bui et al., 2018; Aktas et al., 2019; Liu and Xi, 2021; Driouchi et al., 2022), business strategy and governance (Goel and Thakor, 2008; Goldfarb and Xiao, 2011), earnings quality (Demerjian et al., 2013; Baik et al., 2020; Doukas and Zhang, 2020), credit rating and risk (Bonsall et al., 2017; Cornaggia et al., 2017), innovation (Galasso and Simcoe, 2011; Chen et al., 2015; Koh et al., 2018; Custódio et al., 2019), financial reporting, tax avoidance and tax sensitivity (Koester et al., 2017; Guan et al., 2018; Marquez-Illescas et al., 2019), career, incentives, and risk-taking behavior (Wiersema, 2002; Campbell et al., 2009 and 2011; Custódio et al., 2013; Koijen, 2014; Andreou et al., 2016; John et al., 2017; Yung and Chen, 2018; Song and Wan, 2019; Li and Tong, 2022), and corporate decisions (McCarthy et al., 2017; Gamache et al., 2019; Doukas and Zhang, 2021).

However, existing literature has paid little to almost no specific attention to the impact of key subordinate executives' confidence and ability - *SubEx_ConAbl* (that would help monitor/improve CEO actions) on corporate issues and policies. Limited studies such as Cheng et al. (2016), Jain et al. (2016), and Mekhaimer et al. (2022) have, so far, discussed the importance of key subordinate

executives' confidence and ability in corporate decision-making and outcome from a distant perspective (i.e., only linking the ability and confidence with their horizon).[5] This study attempts to complement those studies and fill the bigger void in the literature.

How may *SubEx_ConAbl* (to effectively monitor the CEO) play a role in corporate risk-taking and decision-making? Extant literature on agency-related issues provides evidence that CEOs' empire-building motives, tendency to enjoy a quiet life, career concerns, and self-interested activities affect corporate risk-taking. For example, Amihud and Lev (1981) find that managers at risk of losing a job or professional reputation tend to engage in conglomerate mergers to decrease their largely un-diversifiable employment risk. More recently, Gormley and Matsa (2016) find that firms reduce risk-taking when the managers are more likely to be motivated by career considerations and have greater exposure to firms' risk through personal equity holdings. Similar evidence is provided by Kim and Lu (2011), documenting that higher equity ownership can reduce firm value by entrenching the CEOs and discouraging them from taking risks. Moreover, these studies indicate that CEOs' self-interested activities negatively affect risk-taking to such a level that they may even avoid some value-enhancing risky projects to preserve their own private benefits. One of the solutions to mitigate this agency problem is to formulate a compensation structure that incentivizes CEOs to take value-enhancing risky projects. Coles et al. (2006) provide evidence along this line. They emphasize the importance of option-based compensation and demonstrate that the sensitivity of CEOs' portfolio wealth to stock volatility (Vega) induces CEOs to implement riskier investment and financing policies.

[5] Nevertheless, only the longer horizon is not sufficient to constrain CEO's action as the executives need to have confidence in the long-term firm performance and ability to exert effort. When executives are confident about the improvement of the firm, they perceive that the firm will perform well in the future, so they are more likely to hold vested in-the-money options longer to accumulate wealth instead of exercising them today. So, subordinate executives' holding of the greater proportion of exercisable unexercised in-the-money options compared to the CEO represents their relative confidence in the future long-term firm performance. In addition, since executives' compensation reflects their contribution to the firm, higher compensation indicates their significant influence on the firm. The greater the compensation ratio of executives compared to the CEO, the greater the ability to constrain the CEO's myopic behavior.

Another possible solution is to build a robust governance mechanism that provides checks and balances on the CEOs' activities. For example, John et al. (2008) find that better investor protections help establish strong external governance, providing environments for corporations to undertake riskier but value-enhancing investments. However, even in the absence of such an external mechanism, subordinate executives can constrain self-serving CEO activities and render strong resistance to the CEO's short-termism. For example, controlling CEO Vega and Delta, Kini and Williams (2012) show that promotion-based (tournament) incentives to the non-CEO executives result in higher corporate risk-taking.[6] Though the subordinate executives serve under the CEO and need to comply with the CEO's direction momentarily, the CEO, on the other hand, needs subordinate managers' effort to generate cash flow (Acharya et al., 2011). Suppose the subordinate executives observe the CEO keeping almost all of the cash flow without much investment for the future. In that case, they probably will scale back their effort and hamper current cash flow generation. To avoid this, the CEO would have to invest some fraction of cash flow for the future in motivating the young subordinates to exert greater effort. This practice will eventually create value for the firm even though CEOs are myopic.

Furthermore, subordinate executives are relatively younger and subject to greater risks because their employability hinges on the firm's success. Also, as they may have a career goal of becoming the CEO in the future, they have more incentives to monitor firm activities. When these executives are confident about the firm's long-term success, they accumulate wealth by holding more unexercised exercisable options (Gopalan et al., 2014) if they have a longer perceived horizon within the firm. In addition, their compensation structure indicates that they can contribute to the firm's long-term value creation, and hence they are the ones who can provide strong opposition to the CEOs' short-termism

[6] CEO delta is the dollar increase in wealth for a 1% increase in stock price. CEO Vega is the increase in option wealth for a 0.01 standard deviation increase in stock volatility.

(Jensen and Murphy, 1990; John and John, 1993). Thus, subordinate executives' longer perceived horizons, i.e., their confidence and ability to influence CEOs' decision-making, can curb CEO self-interest and increase corporate risk-taking necessary to firm value creation. Considering the above arguments above, we construct the following main hypothesis for this study (in alternate form):

Ha: Corporate risk-taking increases with subordinate executives' confidence and ability.

3. Data and methodology

3.1 Data

We collect CEO and subordinate executives' compensation and option data from the *ExecuComp* database for S&P 1500 firms from 2001 to 2019.[7] To identify CEOs, we first use *"CEOANN"* and then utilize all the available information when an executive became CEO *"BECAMECEO"* and left as CEO *"LEFTOFC"*. In some cases, when *ExecuComp* fails to identify or misclassify an executive as CEO, we correct this information based on the given date. Following Bebchuk et al. (2011), we restrict the sample to firm-year observations in which the top four executives and CEO compensation data are available. To identify CEOs at the firm-year level, we use the information on the *"date becoming CEO"* and the *"CEO annual flag"*. We rank non-CEO executives based on compensation *(TDC1)* and remove those subordinate executives whose rank is 5th or inferior (i.e., we keep the top 5 executives except for the CEO). We also remove firm-year observations with more than one CEO in a fiscal year. To obtain full employment information of executives, we match *ExecuComp* data with *BoardEx* by using executives' first, middle, and last names, ages, data dates, and company names. Accounting data is obtained from *Compustat*. Following prior literature, we exclude financial firms (SIC 6000–6999), regulated utility firms (SIC 4900–4999), and public service,

[7] Since the full coverage of board independence data (one of the control variables) from *BoardEx* starts from 2001, the sample period starts from 2001. The sample period ends in 2019 to avoid the unusual financial years due to the pandemic.

international affairs, or non-operating establishments (SIC codes higher than 9000). We drop firm-year observations with missing values and the non-positive book value of assets or sales. Following prior literature, we replace missing observations in R&D and advertising with zero. This selection process results in a sample of unbalanced panel data of 13,410 firm-year observations for 1,661 unique firms.[8] The continuous variables are winsorized at the 1% and 99% levels.

3.2 Construction of main variables

3.2.1 *SubEx_ConAbl*

SubEx_ConAbl in this study is defined as the relative confidence and ability of the key subordinate executives to monitor the CEO's actions and contribute to the firm's decision-making process. The higher the relative confidence and ability of subordinate executives, the stronger the effectiveness of internal governance. Relative confidence is proxied by the perceived horizon or option holding ratio, while ability refers to the ratio of compensation. We follow Banerjee et al. (2015) and Malmendier and Tate (2005) to capture key subordinate executives' confidence in the long-term firm performance. We label the relative confidence as *Exec_Confidence* and formally measure it as:

Exec_Confidence = Subordinate executives' mean confidence/CEO confidence

where confidence is the ratio of unexercised exercisable options value to the number of unexercised exercisable options scaled by fiscal year price. Following Kini and Williams (2012), we measure the ratio for the top two to four executives based on the availability of option holding data.[9] The idea is that when executives decide to accumulate their unexercised exercisable options holdings over time,

[8] Due to missing observations or zeros in the denominator of *SubEx_ConAbl* measure, we lose a significant number of firm-year observations.

[9] Untabulated analysis shows that our results remain unchanged even if we use only top four executives. However, we lose a significant number of observations due to missing observations or zero in the denominator of the Exec_Confidence ratio.

they perceive a long horizon within the firm (Jain et al., 2016) and are confident about the long-term firm performance. In such a situation, they are more likely to avoid myopic actions that boost short-term performance but leave the firm before the long-term cost. As the ratio of subordinate executives' confidence to the CEO's confidence increases, subordinate executives' perception of the long-term performance also increases.

We rely on top executive compensation to measure key subordinate executives' monitoring ability. The importance of executive compensation has been studied in the previous literature (Coles et al., 2006; Kini and Williams, 2012). However, since the actual underlying ability of senior executives is not easily discernible, they are judged by their performance. Hence, their performance or promotion-based executives' compensation reflects their relative influence on the key decision-making process in the firm and their ability to monitor the CEOs. To measure the monitoring ability of key subordinate executives, we follow Cheng et al. (2016) and compute the executive pay ratio as follows:[10]

$$Exec\_Payratio = \frac{Average\ annual\ compensation\ of\ key\ subordinate\ executives}{CEO's\ annual\ compensation}$$

Finally, the key independent variable of this study, *SubEx_ConAbl*, is measured by standardizing both Exec_Confidence ratio and Exec_ Payratio and then combining the standardized values.

3.2.2 Measure of corporate risk-taking and channeling variables

We adopt two measures for firm risk-taking, *Return on Assets Volatility (ROA_Vol)* and *Cash Fow Volatility (CF_Vol)*. Risky investments increase the volatility of future accounting returns and cash flow. *ROA_Vol* is measured at year *t+1* as the standard deviation of return on assets from year *t-4* through year *t* (Boubakri et al., 2013). Following John et al. (2008) methodology, we compute *CF_Vol*

[10] Since the level of subordinate executives' compensation varies across firms, unscaled compensation does not capture the relative influence of subordinate executives, so we use scaled compensation.

at year *t+1* as the rolling standard deviation of cash flow from year *t-4* through year *t*. We require at least five years of observations to compute *ROA_Vol* and *CF_Vol*.

One of the ways firms can increase or decrease overall risk is by increasing investment and/or financing risk. To identify the channel through which firms with strong *SubEx_ConAbl* increase/ decrease overall risks, we examine the influence of *SubEx_ConAbl* on investment and financing decisions. To investigate investment decisions, we focus on capital expenditure (CAPX), R&D, intangible assets, and advertising expenses. Intangible assets are measured by combining R&D expenditures and 30% of sales, general and administrative (SG&A) expenses.[11] We use intangible assets in addition to R&D because not all firms have R&D expenditure, and some firms have significant expenditure on building human capital, brand, and customer relationships. We use advertising expenditure to proxy for a firm's brand-building activities. In addition, we look at equity issuance, net leverage, and cash holdings to investigate financing policies. The detailed measures of the variables are provided in the Appendix.

3.3 Baseline model

We employ the following model to examine the impact of *SubEx_ConAbl* on a firm's overall risk-taking (and relevant investment and financing decisions):

$$Y_{i,t+1}=\beta_0+\beta_1 SubEx\_ConAbl_{i,t}+\sum Controls_{i,t}+Year\ FE+Industry\ FE+\varepsilon_{i,t+1} \quad (1)$$

where the dependent variable $Y_{i,t+1}$ represents the firm's overall risk-taking measure or the proxies for investment or financing policies. The key independent variable, *SubEx_ConAbl*, is the sum of the standardized values of *Exec_Confidence ratio* and *Exec_Payratio*. The relationship between

[11] We follow Peters and Taylor (2017) and add 30% of SG&A to R&D expenditures to construct intangible capital. We include part of SG&A in the measure because firms invest in knowledge capital (R&D) and organizational capital, including human capital, brand, customer relationships, and distribution systems.

SubEx_ConAbl and firm risk-taking could be affected by correlated omitted variables. We, therefore, include several control variables that are shown to be associated with our dependent variables. Specifically,we include sales growth, market-to-book ratio, annual stock returns, firm size, firm age, leverage, tangible assets, top management team delta and vega, CEO delta and vega, CEO age, CEO tenure, CEO stock ownership, the board size, and board independence. The details of the measures are provided in the Appendix.

4. Results and discussions

4.1 Descriptive statistics, correlations, and univariate analysis

Table 1 reports the descriptive statistics for the variables used in the regression analyses. The component of the key independent variable *Exec_Confidence ratio* has a mean (median) of 1.152 (0.921), which means that subordinate executives are, on average, more confident than the CEO of the long-term firm performance. On the other hand, the mean (median) pay ratio of subordinate executives relative to the CEO is 0.446 (0.373). The mean (median) value of the independent variable, *SubEx_ConAbl*, is -0.000 (-0.386). These findings are generally consistent with the statistics reported in Cheng et al. (2016) and Jain et al. (2016). Average cash flow volatility (0.052) is higher than average return on assets volatility (0.042), indicating that firms increase cash flow risk more than the return on assets risk. The average growth and investment rates indicated by the sales growth and market-to-book ratios are 0.104 and 3.453, respectively. On average, firms report 19.2% annual returns, invest 9.7% and 1.3% of assets in intangibles and advertising, respectively, and 23.3% of property, plant, and equipment in capital expenditure. On the financial side, average firms hold leverage of approximately 22% of the total assets, hold 11.6% of total assets as cash, and issue equity of approximately 1% of total assets.

[Insert Table 1 about here]

Panel A of Table 2 presents the correlation matrix of dependent and independent variables. As expected in the hypothesis, the risk-taking proxies are positively correlated with the key independent variables. The correlation (0.000) between subordinate executives' confidence ratio (Exec_Confidence) and ability to influence (Exec_Payratio) CEOs' decisions is zero, indicating that these two variables capture different aspects. Un-tabulated variance inflation factor (VIF) analysis demonstrates that none of the correlations between control variables are high enough to impose a multicollinearity problem.

Panel B of Table 2 reports our univariate analysis of the mean differences (i.e., high minus low) of our dependent variables (ROA_Vol and CF_Vol) when our sample is sub-grouped into different quintiles (Q1 representing the lowest quintile and Q5 representing the highest quintile) based on our key independent variable (SubEx_ConAbl). Consistent with our hypothesis, we find positive differences (between high and low quintile groups) in the mean values for both ROA_Vol (0.0075) and CF_Vol (0.0012) that are statistically significant at the 1% level (i.e., *p-value <0.01*).[12]

[Insert Table 2 about here]

4.2 Baseline results

This section reports our baseline findings – i.e., the relationship between *SubEx_ConAbl* and firm risk-taking measured by ROA_Vol and CF_Vol. These two volatility factors could reflect the increase or decrease in business risk. We use the log of ROA_Vol and CF_Vol in the regression analysis. Column 1 in *Panel A of Table 3* reports the regression results of the impact of *SubEx_ConAbl* on ROA_Vol, where we document a positive and statistically significant relationship. This finding, consistent with our hypothesis, suggests that when subordinate executives are confident and possess

[12] We find similar univariate outcomes regardless of the conventional basis of sample partitions, such as for upper vs. lower median, tercile, or quartile.

the ability to monitor CEO's actions, the firm's risk-taking increases. Economically speaking, a one standard deviation increase in *SubEx_ConAbl* increases ROA_Vol by 4.19%.[13]

[Insert Table 3 about here]

In column 4, when we use CF_Vol as the proxy for corporate risk-taking, we find similar positive and significant results at a 1% significance level. Economically, a one standard deviation increase in *SubEx_ConAbl* increases the CF_Vol by 5.41%.[14] Moreover, columns 2 and 3 (columns 5 and 6) show that the two components of *SubEx_ConAbl* (i.e., *SubEx_Confidence* and *Exec_Payratio*) are also significantly and positively associated with ROA_Vol (CF_Vol), suggesting that executives' confidence and greater ability, separately, can enhance firm risk-taking. Overall, the findings provide evidence that subordinate executives' confidence in long-term firm performance and ability to constrain CEO's myopic behavior are important factors that positively affect corporate risk-taking. As predicted, the results on control variables are generally consistent with prior studies. Especially we find that large and mature firms tend to reduce firm risk compared to small and young firms. The results also suggest that profitable firms with more available funds reduce firm risk. Consistent with Kim and Lu (2011), our results show that CEOs with high ownership stakes in the firm reduce firm risks as they cannot diversify their portfolio. On the other hand, our findings indicate that firms increase risk-taking when they have high growth opportunities and are highly levered. As expected CEO's longer horizon and CEO pay also affect risk-taking positively.

Moreover, we argued earlier that *SubEx_ConAbl* should have an incremental impact on corporate risk-taking over the "horizon" only, as documented in Mekhaimer et al. (2022). Accordingly, we find evidence that subordinate executives' horizon *(Exec_Horizon)* increases corporate risk-taking

[13] The economic significance of log-transformed dependent variable is estimated as ((exp(0.0292)-1)*100)*1.415=4.19%, where 1.415 is the standard deviation of *SubEx_ConAbl*.
[14] Calculated as ((exp(0.0375)-1)*100)*1.415 = 5.41%

meaningfully only within the high zone of *SubEx_ConAbl*. We report this set of results in *Panel B of Table 3*.

4.3 Corporate investment and financing decisions and their channeling effects

So far, we argue that some of the mechanisms through which firms with strong *SubEx_ConAbl* increase risk-taking are investment and financing decisions. We now focus on how these corporate decisions may affect the relationship between *SubEx_ConAbl* and firm risk-taking. To examine the indirect mediating effect of corporate decisions, we follow the methodology used by Ferris et al. (2017) and build the following three models.

$$Risk\text{-}Taking = f(SubEx\_ConAbl, Controls) \quad (2)$$

$$Corporate\ Descisions = f(SubEx\_ConAbl, Controls) \quad (3)$$

$$Risk\text{-}Taking = f(SubEx\_ConAbl, Corporate\ Decisions, Controls) \quad (4)$$

Equations (2) and (3) show how *SubEx_ConAbl* would affect risk-taking and corporate decisions. Equation (4) shows the mediating or channeling effect of such corporate decisions. The idea is that *SubEx_ConAbl* may affect investments and financing decisions, which, in turn, influence ROA_Vol and CF_Vol. We already document positive and significant relationships from equation (2) as our baseline findings (*Panel A of Table 3)*. In *Panel A of Table 4*, following equation (3), we report how *SubEx_ConAbl* influences various corporate (investment and financing) decisions. Specifically, we look for R&D, intangible assets, and advertising expenditure to capture risky investments as the return from these investments takes a longer time to be realized, and a lot of management effort is required to make these investments successful. We also analyze capital expenditure which is comparatively less risky. Columns (1) to (4) show that the coefficients of *SubEx_ConAbl* are positive and statistically significant. The findings suggest that firms with strong *SubEx_ConAbl* increase both

less risky and risky investments.

As the riskiness of a firm's financing policy affects the overall firm risks, we also look for cash holding, equity issuance, and net leverage. The riskier financing policy may negatively affect a firm's value as it likely creates distress risk. Columns (5) and (6) show that the coefficients of *SubEx_ConAbl* are positive and significant for cash holding and equity issuance. However, the coefficient for net leverage in column (7) is negative and significant.[15] These findings suggest that firms with strong *SubEx_ConAbl* increase equity issuance, a costly means of raising capital, but do not significantly increase leverage or hold more cash to probably finance the risky investments or balance the cost associated with equity issuance. Also, firms increase costly financing but, at the same time, increase liquidity to reduce the burden of the leverage. Overall, firms with strong *SubEx_ConAbl* increase risky investments that improve the firm value and finance the investment by increasing equity issuance and holding more cash. This balancing activity might protect firms from taking excessive risks and increase the firm's overall value.

[Insert Table 4 about here]

Next, we test equation (4) for channeling effects by including these corporate decisions at year *t* into the relationship between *SubEx_ConAbl* at year *t* and risk-taking measures at year *t+1*. Since leverage is also a proxy for financing decisions, we exclude leverage from the original equation (1) and rerun the model to quantify the cleaner channeling effect of those variables. *Panel B of Table 4* presents equation (4) results for which ROA_Vol and CF_Vol are the dependent variables. Column (1) shows the re-estimated coefficient of *SubEx_ConAbl* from equation (2). From columns (2) to (8), we include proxy variables for the investment and financing decisions and observe the reduction in the coefficient

[15] Our further (unreported) analysis shows that leverage, long-term debt, and short-term debt are all insignificant, suggesting that the negative and significant effect on net leverage is driven by holding more cash.

of *SubEx_ConAbl* from the original coefficient in column (1).[16] The reduction in coefficient indicates the channeling effect of investment and financing decisions. The channeling effect shows that investment and financing decisions significantly increase ROA_Vol by around 24.32% and 28.77%, respectively.[17]

Similarly, for CF_Vol (reported in columns (6) and (7)), the effects are 20.33% (investment decisions) and 15.88% (financing decisions). Overall, the combined effect of corporate decisions reflected in columns (4) and (8) shows that firms with strong *SubEx_ConAbl* channel approximately 41% and 28% of the ROA_Vol and CF_Vol through corporate investment and financing decisions.

4.4 Endogeneity

Although we find strong empirical support for our hypothesis, there could be several endogeneity concerns that deserve further consideration. For instance, an important concern could be that a firm's risk-taking might affect its executives' confidence and ability. In other words, firms that take highly calculated risks might increase firm performance, which in turn increases executives' compensation, leading to a reverse causality issue. Another vital concern could be that our results are driven by some unobservable omitted firm characteristics. To alleviate such endogeneity issues and to ensure the validity of our main findings, we further conduct several econometrically established tests that we report below.

4.4.1 Two-stage least square (2SLS) approach

[16] We do not include R&D as a channeling corporate (investment) factor in this analysis to avoid multicollinearity issues as the factor "intangibles" is defined as R&D plus 30% of sales, general and administrative (SG&A) expenses, scaled by total assets following (Peters and Taylor, 2017).

[17] % of total effect channeled for column (2): 0.0071/0.0292 = 24.32%, and for column (3): 0.0084/0.0292 = 28.77%. Here, 0.0292 is the coefficient on *SubEx_ConAbl* from column (1), and 0.0071 and 0.0084 are the deviations in *SubEx_ConAbl* coefficients when the investment and financing factors are included, respectively, in columns (2) and (3).

To mitigate such reverse causality concerns, we first employ a two-stage least square (2SLS) approach. We follow Cheng et al. (2016) and use the number of named executives as an instrument that is not supposed to affect firm risk-taking directly but only through *SubEx_ConAbl*. We believe that the instrument is valid as the greater number of named executives is exogenous and does not directly affect a firm's risk-taking but is supposed to increase the effectiveness of *SubEx_ConAbl* by creating more pressure on the CEOs' myopic behavior. We present our first stage result in column (1) of *Panel A of Table 5*. The results show that the instrument is positively and significantly associated with *SubEx_ConAbl*. We then use predicted *SubEx_ConAbl* from the first stage to examine whether our baseline findings reported in *Panel A of Table 3* hold. Our findings in columns (2) and (3) show that the coefficient of the predicted *SubEx_ConAbl* measure is stronger and positively associated with firm risk-taking. The weak identification test (*Cragg-Donald Wald F statistic*) is statistically significant, indicating that the instrument is relevant and powerful. The significant *p-value* test also suggests that endogeneity is unlikely to be an issue.

[Insert Table 5 about here]

4.4.2 Difference-in-difference (DiD) approach

Next, we use the *difference-in-difference (DiD)* approach. Again, following Cheng et al. (2016), we examine how the new appointment of key executives as independent directors on other firms' boards has an impact on corporate risk-taking. The idea is that if confident and able executives start serving on another firm's board, they will gain experience monitoring the CEO's actions. So, the effectiveness of contrasting CEO short-termism is supposed to strengthen along with their confidence and ability. As in Cheng et al. (2016), we construct two variables: 1) *CID_FIRM* and (2) *POST_CID_FIRM*. The variable *CID_FIRM* is an indicator that equals one if the firm has at least one key executive who holds independent directorships in other firms during the sample period and zero otherwise. The

POST_CID_FIRM variable is an indicator that equals one for firm years after the first key executive is appointed as an independent director in other firms and zero otherwise. The coefficient on *CID_FIRM* shows the difference in corporate risk-taking between firms with key subordinate executives being externally appointed as independent directors (i.e., treatment firms) and the other firms in the pre-appointment period. The coefficient on *POST_CID_FIRM* captures the incremental effect of *CID_FIRM* on corporate risk-taking after the appointment of key executives as an external independent director.[18] Columns (4) and (5) of *Panel A of Table 5* report the result of *DiD* analysis. The coefficients of the key variable (*POST_CID_FIRM*) are positive and significant for both ROA_Vol and CF_Vol, suggesting that key subordinate executives have a causal effect on corporate risk-taking after they are appointed independent directors in other firms. This finding indicates that subordinate executives have influence within their own firms.

4.4.3 Use of firm fixed effect in the baseline model

Next, we re-run our baseline model switching the industry fixed effect to firm fixed effect to address the concern that firm-specific omitted factors may affect our inferences. Results from this analysis reported in *Columns 6 and 7 of Panel A of Table 5* remain qualitatively similar to our earlier baseline findings using our original model specification. Overall, our results show that corporate risk-taking increases with *SubEx_ConAbl*, and our findings hold regardless of the fixed effect we use in our model specification.

4.4.4 Oster (2019) test for omitted variable bias concern

Further, to mitigate the concern related to the possibility of omitted variable bias, we employ the Oster (2019) test that augments the methodology of Altonji et al. (2005) and checks for the stability

[18] Since the post-appointment period is subsumed by the year fixed effects, it is not included separately in the regression. Here, *POST_CID_FIRM* represents the interaction between the *CID_FIRM* and an indicator for the post-appointment period.

of the coefficients on the variable of interest in the regression model (i.e., *SubEx_ConAbl* in our study). This test has been widely used in the recent economic and business literature (see e.g., Mian and Sufi, 2014; Smith, 2016; Bernard et al., 2021; Lim and Nguyen, 2021; Lin et al., 2021; Zhang, 2021; Pierri and Timmer, 2022). The Oster (2019) test explicitly tracks the changes in the explainability of the model by considering hypothetical controls in the regression model to reach the maximum hypothetical value of *R-square* (i.e., up to 100%). Suppose the maximization process of *R-square* with the addition of the hypothetical controls leaves the coefficient reasonably stable without changing the direction of the findings. In that case, it is considered *"free of omitted variable bias."* This test requires the pre-selection of an identified set of the proportionality between observed and unobserved controls. Then it captures the possibility of inclusion of zero within the range between each of the values in the identified set and the maximum *R-square* value. The null hypothesis that the omitted variable probably drives the results is rejected *if and only if* no zero is found within those ranges.

Accordingly, to conduct the test, we pre-select the identified set as: $\left[\tilde{\beta}, \beta^{*\prime}\right]$ where $\beta^{*\prime}$ is computed from the following equation:

$$\beta^{*\prime} = \tilde{\beta} - \delta\left[\dot{\beta} - \tilde{\beta}\right]\frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}} \qquad (5)$$

In Eq. (5), $\tilde{\beta}$ denotes the coefficient of our key independent variable (i.e., *SubEx_ConAbl*), and $\tilde{R}$ is the *R-square* value of our baseline model (including control variables and fixed effects). $\dot{\beta}$ and $\dot{R}$ are their counterparts from the regression without considering any control variables and fixed effects. As of Oster (2019) suggestion, we choose δ equals 1 (i.e., equal importance of the observed vs. unobserved controls). Following Mian and Sufi (2014), we select the value $R_{max} = \min(2.2\tilde{R}, 1)$ as the highest upper bound as well as observed the scenario for $R_{max} = \min(1.25\tilde{R}, 1)$, $R_{max} = \min(1.5\tilde{R}, 1)$, and $R_{max} = \min(1.8\tilde{R}, 1)$. The results are presented in *Panel B of Table 5*. Overall, the

findings suggest that our identified sets safely exclude zero and thus the relationship between *SubEx_ConAbl* and our corporate risk-taking measures *ROA_Vol* and *CF_Vol* are statistically unlikely to be suffering from the omitted variable bias.

4.4.5 Propensity score matching (PSM) and entropy balancing (EB)

As we use in this study, the OLS regression model can be susceptible to model misspecification concerns if the assumed linearity between the dependent and independent variables does not hold. However, this issue can be largely mitigated with a *Propensity Score Matching (PSM)* sample, as the construction of this sample ensures that there is no pre-existing functional relationship between the dependent variable and the covariates (Rosenbaum and Rubin, 1983; Jha and Chen, 2015). Moreover, Using the PSM sample helps mitigate sample selection-bais concerns (Fang et al., 2014). Following extant literature, to construct the PSM sample, we first split our main sample into high (control) vs. low (treatment) sub-groups based on the median value of our key independent variable *SubEx_ConAbl*. We then use a logit regression model to calculate the propensity scores for both treated and control sub-groups, where we keep all the variables and fixed effects as in our main model. This process gives us an equal of observations from each group after matching (4,041 treatment and 4,041 control firm-year observations). Following Shipman et al. (2017) and others, we rerun our baseline regression using the newly constructed PSM samples and report the results in *Columns 1 and 2 of Panel C of Table 5*. We continue to find a positive (and significant) association between *SubEx_ConAbl* and corporate risk-taking (using both ROA_Vol and CF_Vol). We report the results of the diagnostics tests in the Appendix, showing no meaningful differences between the covariates of treatment and control sub-groups. Notably, we do not find any statistically significant differences between treatment and control groups for any of the covariates.

Although the PSM approach is widely used, it has some drawbacks, such as losing many observations from the primary sample. To mitigate this concern, we employ a novel approach known as *Entropy Balancing (EB)* that can eliminate considerable differences (arguably in a more convincing way) between the covariates of treatment and control sub-groups (through adjustments in mean, variance, and skewness) without dropping the observation and conserving valuable information in the processed data (Hainmueller, 2012; McMullin and Schonberger, 2020). This approach has gained traction in emerging economic and business literature due to its evident and superior utility (see e.g., Amiram et al., 2017; Chapman and Green, 2018; Bao and Huang, 2021; Levy, 2021; Overesch and Wolff, 2021; Beck et al., 2022). We implement this approach in our context by following the methodology of Hainmueller (2012) and achieve convergence from all three key dimensions (i.e., mean, variance, and skewness). We report the baseline regression results using the sample constructed through this approach in *Columns 3 and 4 of Panel C of Table 5*. Notably, the outcome of using the EB sample is consistent with our premary findings. We report the proof of entropy balancing (i.e., before and after comparisons for all the variables used in our primary model) in the Appendix.

4.5 Additional robustness checks

4.5.1 Alternative measures of *SubEx_ConAbl*

We use CEO pay in the denominator to compute executives' pay ratio as the component of the *SubEx_ConAbl* measure. However, a lower pay ratio may not capture executives' influence on CEO decision-making. For example, it could indicate that CEOs are entrenched (Bebchuk et al., 2011), and entrenched CEOs increase firm risk. Therefore, we construct the following alternative measure for executives' compensation to alleviate this concern following Cheng et al. (2016) and Core et al. (2008):

$$Y_{i,t}=\beta_0+\beta_1 Log(sale)_{i,t-1}+\beta_2 S\&P500_{i,t}+\beta_3 BM_{i,t-1}+\beta_4 Stock\ Return_{i,\ t}+\beta_5 Stock\ Return_{i,\ t-1} \\ +\beta_6 ROA_{i,\ t}+\beta_7 ROA_{i,\ t-1}+IndFE+YearFE+\varepsilon_{i,t} \quad (6)$$

where $Y_{i,t}$ is the log of mean total compensation of subordinate executives, $Log(sale)_{i,t-1}$ is the log of prior year sales to proxy for firm size, $S\&P500_{i,t}$ is an indicator variable of the firm's S&P 500 membership, $Stock\ Return_{i,\ t}$ is the current year stock return, $Stock\ Return_{i,\ t-1}$ is prior year stock return, $ROA_{i,\ t}$ is current year profitability and $ROA_{i,\ t-1}$ is prior year profitability. We compute the residual from this regression and standardize it to compute the abnormal compensation. This abnormal pay is not subject to an alternative explanation as it captures the executive's market value. To construct an alternative *SubEx_ConAbl* measure, we add standardized abnormal compensation to the standardized *Exec_Confidence* ratio. Using the alternative proxy for *SubEx_ConAbl*, we re-run the regression models for our corporate risk-taking, and investment and financing policy measures and find qualitatively similar results in *Panel A of Table 6*.

[Insert Table 6 about here]

As our second alternative measure, we scaled the *Exec_Payratio* by the total assets instead of the CEO's total compensation. The third alternative measure takes the natural logarithm of the mean total compensation of the subordinate executives. As the fourth alternative measure, we calculate the *Exec_Confidence* ratio using the option's moneyness. To calculate the moneyness of the option, we subtract the ratio of unexercised exercisable options value to the number of unexercised exercisable options from the fiscal year price and then scaled the difference by the ratio of unexercised exercisable options value to the number of unexercised exercisable options. Our fifth alternative measure uses the median instead of the mean to measure the *Exec_confidence* ratio and *Exec_Payratio*. Finally, we address the concern that our results could be driven by highly overconfident executives' tendency to increase risks. To measure the subordinate executives' overconfidence, as our sixth alternative measure, we follow Malmendier and Tate (2005) and consider top non-CEO management team to be

overconfident if the mean in-the-money option holding (confidence measure) by subordinate executives is more than 67% and their mean tenure is more than or equal to five years. We then removed the observations of overconfident executives and rerun the models. *Panel A of Table 6* shows that our main results still hold in all these alternative measures.

4.5.2 Alternative proxies for risk-taking

To mitigate the concern that the findings are tied to a specific measure of risk-taking proxies, we construct four alternative proxies for risk-taking. *First*, we measure stock return volatility as the annualized standard deviation of daily stock returns in year t+1 (Coles et al., 2006; Gormley and Matsa, 2016; Kini and Williams, 2012). *Second*, we compute idiosyncratic volatility by regressing daily stock return on market return. Idiosyncratic risk is the annualized standard deviation of the error term from the regression. *Third*, we follow Lee et al. (2021) and estimate systematic risk as a coefficient of daily market return using the same market model used to estimate idiosyncratic risk. *Finally*, following Gormley and Matsa (2016), we measure operating asset volatility as the product of a firm's stock volatility and its market value ratio of equity to operating assets. We use the natural logarithm of all the risk-taking measures. The results reported in *Panel B of Table 6* show that a positive and significant relationship between *SubEx_ConAbl* and a firm's risk-taking proxies still holds. Moreover, they are qualitatively similar to the main findings.

4.6 Cross-sectional tests

4.6.1 Product market competition

Product market competition could affect the relationship between *SubEx_ConAbl* and a firm's investment and financing decisions and the firm's overall risk-taking. For example, Hou and Robinson (2006) document that firms in highly concentrated industries are less risky because they engage in less innovation. On the other hand, Giroud and Mueller (2010, 2011) find that the competitive market

acts as an external governance mechanism. They find that weak governance firms in non-competitive industries experience lower equity returns, worse operating performance, and thus lower firm value. Also, input costs, wages, and overhead costs increase only in non-competitive industries. However, in competitive industries, firms do not experience such negative outcomes. Since product market competition increases external governance, we expect that the effectiveness of a firm's *SubEx_ConAbl* will be more pronounced in competitive industries.

To proxy for the competition, we use the Herfindahl-Hirschman Index (HHI), measured as the sum of the squares of the percentage market share of firms (under Fama & French 48 industry classification). By excluding negative, zero, and missing sales observations, we calculate market share for each year as the ratio of firm sales to total industry sales. HHI is inversely related to market competition (i.e., the higher the value of HHI, the lower the competition and the higher the concentration). In this study, we follow the methodology used by Giroud and Mueller (2011) to compute the HHI dummy. We first calculate the tercile of HHI and then create a dummy variable for HHI (low) equal to one if HHI is in the lowest tercile and zero otherwise. Similarly, we create categorical variables for HHI (medium) and HHI (high). The main coefficient of interest is the interaction term between the *SubEx_ConAbl* and the HHI (high) dummy.

Panel A of Table 7 presents the results of the impact of *SubEx_ConAbl* on a firm's investment and financing policy conditioning on the market competition. Columns (1) and (2) show that the interaction term between *SubEx_ConAbl* and competition is statistically significant and positive, and the coefficients' magnitude increases with the level of competition. The results indicate that the effectiveness of *SubEx_ConAbl* is more pronounced when competition increases. When competition moves from medium to high, we observe a more pronounced effect on R&D, intangibles, advertising, and cash. However, we observe the opposite effect in less risky investments, CAPX. Overall,

consistent with our expectation, the findings further increase our confidence that stronger *SubEx_ConAbl* practices and external governance in the firm lead to a more pronounced effect in risky investments and less risky financing policies. Moreover, the findings support Acharya et al. (2011) that external governance can complement bottom-up internal governance through *SubEx_ConAbl*.

[Insert Table 7 about here]

4.6.2 Firm complexity

Complex firms are difficult to manage, and the CEO needs substantial support from the key subordinate executives to implement the business strategy and improve firm performance. Graham et al. (2015) find that the CEOs delegate financing decisions for which they need the most input, when they are overloaded, and when they are distracted by recent acquisitions. The survey evidence of the authors also suggests that top non-CEO managers perform important functions, especially in large and complex firms. In such a complex business environment, it is not easy for the CEO to expropriate assets for personal benefit, as decisions are usually delegated among the non-CEO executives. Therefore, we expect that subordinate executives' efforts and contributions are more pronounced when firms become more complex.

To proxy for firm complexity, we estimate the principal component of the number of geographical segments, firm size, and R&D expenses. We interact tercile of complexity measure with the *SubEx_ConAbl* to test the impact of firm complexity on the relationship between *SubEx_ConAbl* and corporate risk-taking measures. *Panel B of Table 7* shows that the coefficients of the interaction term with the high firm complexity measure are positive and significant, with higher coefficient magnitudes for all columns except column (8). The results support the notion that high firm complexity enhances the effectiveness of *SubEx_ConAbl*.

4.6.3 Subordinate executives' experience

Experienced subordinate executives are supposed to have better capability than inexperienced subordinates to constrain CEO's myopic behavior. However, with the experience, executives also get older, and older executives might have comparatively less incentive and confidence in increasing risky investments and ultimately increasing overall corporate risks (Mekhaimer et al., 2022). To examine the impact of experience, we follow Antia et al. (2010) and measure the industry-adjusted experience of the subordinate executives:

$$Subordinate\ Executives'\ Experience = \left[Tenure_{i,t} - Tenure_{ind,t}\right] + \left[Age_{i,t} - Age_{ind,t}\right] \quad (7)$$

where $Tenure_{i,t}$ is the mean number of years that subordinate executives have been with the firm *i*, and $Age_{i,t}$ is the mean age of the subordinate executives. $Tenure_{ind,t}$ is the industry median of tenure, and $Age_{ind,t}$ is the industry median of age. *Panel C of Table 7* shows that the interaction term between *SubEx_ConAbl* is positive and significant only for low and medium-experienced executives for all the investment activities. We also observe that the magnitude of the coefficients of investment activities decreases with experience. The results indicate that confident and capable subordinate executives with low and medium experience still increase the investment risk but with a lower magnitude.

However, we see the opposite effect in financing policies. The highly experienced, confident, and capable executives increase cash holding and issue more equity. Since financing policies have a lesser impact on corporate risk-taking, we find a comparatively lower magnitude of coefficients in columns (1) and (2) for highly experienced executives. Overall, our results show that *SubEx_ConAbl* has a greater impact on corporate risk-taking when executives are less experienced, indicating younger executives are more risk-seeker than older executives.

4.7 Additional analyses

4.7.1 *SubEx_ConAbl*, firm value, and innovation efficiencies

Our empirical evidence shows that stronger *SubEx_ConAbl* can positively affect corporate risk-taking. However, higher risk-taking could have a differential impact on the firm value. It could reduce firm value if the risk is not adequately controlled. In order to grow, firms often require taking some risks that will ultimately benefit the shareholders. Gormley and Matsa (2016) find that CEOs with greater exposure to their firms' risk through personal equity holdings play safe and reduce firms' risk by increasing investments in less risky assets. They argue that firms need to design governance mechanisms that motivate managers to take necessary risks to maximize shareholder value. The analysis in this study finds evidence along this line that subordinate executives' confidence and ability motivate firms to take more risks. However, the question is whether this increase in risk-taking improves firm value. Therefore, we test whether firms with strong *SubEx_ConAbl* increase firm value. *Panel A of Table 8* presents the results and shows *SubEx_ConAbl* is positively and significantly associated with Tobin's Q and gross margin, the proxies for firm value (see columns 1 and 2). Overall, the evidence suggests that *SubEx_ConAbl* increases firm risk-taking, which, in turn, increases firm value.

Additionally, we test whether the increased investment in R&D (reported in *Column 2 of Panel A of Table 4)* leads to innovative efficiency to improve the firm performance. We expect that firms with strong *SubEx_ConAbl* will focus on long-term gain from the R&D expenditure, so these firms are expected to experience more value-enhancing patent and citation activities. We follow Kogan et al. (2017) to test this conjecture and collect patent-related KPSS data from the authors' shared database.[19] We take the natural logarithm of the number of patents, the number of citations, and the number of citations scaled by the number of patents to measure a firm's innovation output. Additionally, we consider the value of the patents. We report the results in *Columns 3 to 6 of Panel A of*

[19] https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data

Table 8. Albeit we get an insignificant outcome for Patent in column (3), column (4) suggests that innovation output (proxied by citation) increases with strong *SubEx_ConAbl*. In addition, results in columns (5) and (6) suggest that firms with strong *SubEx_ConAbl* increase the average patent quality and the value. Overall, firms with strong *SubEx_ConAbl* increase corporate risk-taking (not excessive) by improving the investments in patents and citations, a strategy that increases firm value.

[Insert Table 8 about here]

4.7.2 CEO power and overconfidence

The positive impact of internal governance could be weakened when CEOs are powerful. Powerful CEOs can overcome opposition from other executives and directors and consistently (often significant) influence and control key strategic decisions within a firm (see e.g., Haleblian and Finkelstein, 1993 and Baldenius et al., 2014). If the CEOs become entrenched due to excessive power, they may be less willing to accept the advice of others due to their exaggerated opinion of their own abilities. To test the possibility that powerful CEOs could undermine the positive impact of *SubEx_ConAbl* on corporate risk-taking, we construct a meaningful proxy for CEO power by combining the following factors: CEO duality, CEO tenure dummy, CEO share ownership dummy, CEO founder dummy, CEO pay slice, dependent executives dummy, CEO only insider dummy, and CEO connection with independent director dummy[20]. We take the principal component from those factors and define "CEO power" as a dummy variable equal to one if the CEO power score (from the principal component) is greater than the sample top tercile. Finally, we interact CEO power dummy with *SubEx_ConAbl*. We report the results in *Columns 1 and 2 of Panel B of Table 8* that show that the interaction terms are negative and significant, indicating that powerful CEOs undermine the

[20] See, for example, Hill and Phan, 1991; Rechner and Dalton, 1991; Daily and Johnson, 1997; Brookman and Thistle, 2009; Pathan, 2009; Bebchuk et al., 2011; Kim and Lu, 2011; Yang and Zhao, 2014; etc.

positive and value-enhancing corporate risk-taking.

Moreover, CEO overconfidence could also affect a firm's investment and financing policies. For instance, when CEOs are overconfident, they are less likely to take suggestions from subordinate executives. As a result, the positive impact of *SubEx_ConAbl* could be less pronounced or may reverse altogether. To examine this prediction, we follow Banerjee et al. (2015) and Malmendier and Tate (2005) and compute option-based measures to proxy for CEO overconfidence. When CEOs are overconfident, they are more likely to hold a high proportion of vested options even though they can exercise in-the-money options. To compute the overconfidence measure, we first collect option grant information from *Execucomp*, divide the value of all unexercised but exercisable options by the number of options vested, and then scale it by the fiscal-year-end stock price. We then create a categorical variable, *Overconfident_CEO*, equal to one if the CEO tenure is greater than or equal to five and holds more than 67% of options at least twice during the CEO tenure. We then interact the *Overconfident_CEO* dummy with the *SubEx_ConAbl* measure. As expected, the results reported in *Columns 3 and 4 of Panel B of Table 8* show that the interaction term is negative and significant for ROA volatility but insignificant for cash flow volatility.

5. Conclusion

We document that the key subordinate executives' confidence and ability spur corporate risk-taking behavior by closely monitoring the CEO's actions and providing vital support in improving financing, investment, and innovation efficiencies, thus firm value. Intuitively, such executives usually have a longer horizon (i.e., time left towards typical retirement) in the firm and arguably tend to care more about the firm's future long-term performance as their career advancement is tied to it (Cheng et al., 2016; Jain et al., 2016; Mekhaimer et al., 2022). We argue that their confidence and ability (*SubEx_ConAbl)* are the underlying factors that make horizons fruitful in corporate risk-taking.

Specifically, we find that firm-level risks such as ROA and cash flow volatilities increase with *SubEx_ConAbl*, resulting in increased financing, investment, and innovation efficiencies leading to a higher firm value. Our findings are verified by a battery of robustness and endogeneity tests. Much of the heterogeneities within the positive relationship between *SubEx_ConAbl* and corporate risk-taking are attributable to the factors like market competition, operational complexities, and subordinate executives' experience. Our additional findings suggest that the positive impact of *SubEx_ConAbl* on corporate risk-taking in a firm attenuates when the CEO is highly powerful or overconfident. Overall, our findings help grow the nuance literature on key subordinate executives and contribute to several sub-streams of corporate governance literature, such as corporate risk-taking, agency issues, internal governance, and managerial characteristics.

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Table 1: Descriptive statistics

	N	Mean	Median	Std. Dev.	p25	p75
Dependent Variables						
ROA Vol	13408	0.040	0.026	0.043	0.015	0.048
CF Vol	13408	0.052	0.030	0.063	0.016	0.059
Tobin's Q	13408	2.114	1.731	1.251	1.316	2.454
Gross Margin	13408	0.416	0.387	0.216	0.258	0.566
CAPX	13408	0.233	0.198	0.139	0.135	0.295
R&D	13408	0.034	0.007	0.056	0.000	0.046
Intangibles	13408	0.097	0.080	0.080	0.036	0.135
Advertising	13408	0.013	0.000	0.028	0.000	0.012
Cash	13408	0.116	0.082	0.112	0.033	0.163
Equity Issuance	13408	0.009	0.005	0.082	-0.014	0.021
Net Leverage	13408	0.070	0.103	0.288	-0.115	0.262
Independent Variables						
Exec_Confidence	13408	1.152	0.921	1.264	0.693	1.111
Exec_Payratio	13408	0.446	0.373	0.284	0.290	0.502
SubEx_ConAbl	13408	-0.000	-0.386	1.415	-0.770	0.215
Control Variables						
Sales Growth	13408	0.104	0.077	0.211	0.006	0.167
MB Ratio	13408	3.453	2.580	4.653	1.689	4.056
Annual Return	13408	0.192	0.138	0.437	-0.076	0.376
Firm Size	13408	7.639	7.533	1.598	6.493	8.679
Log(Firm Age)	13408	3.157	3.178	0.684	2.639	3.761
Leverage	13408	0.223	0.210	0.185	0.059	0.330
Distress	13408	0.045	0.000	0.208	0.000	0.000
CEO Delta	13408	5.759	5.704	1.338	4.876	6.571
CEO Vega	13408	4.397	4.503	1.475	3.538	5.413
CEO Age	13408	4.014	4.025	0.127	3.932	4.094
CEO Tenure	13408	7.895	6.000	6.900	3.000	10.501
Share Ownership	13408	0.015	0.003	0.037	0.001	0.009
Board Size	13408	9.274	9.000	2.224	8.000	11.000
Independent Board	13408	0.607	1.000	0.489	0.000	1.000

Notes: This table presents the descriptive statistics of the dependent, independent, and control variables. The sample consists of S&P 1500 firms for the period 2001-2019. Appendix A.1 provides a detailed description of the variables.

Table 2: Correlation matrix and univariate analysis

Panel A: Correlation matrix of the main variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) ROA_Vol	1.000													
(2) CF_Vol	0.699	1.000												
(3) Tobin's Q	0.232	0.118	1.000											
(4) Gross Margin	0.097	0.089	0.336	1.000										
(5) CAPX	0.219	0.191	0.257	0.259	1.000									
(6) R&D	0.418	0.409	0.323	0.332	0.273	1.000								
(7) Intangibles	0.358	0.342	0.370	0.396	0.315	0.719	1.000							
(8) Advertising	0.027	0.040	0.144	0.244	0.114	-0.032	0.206	1.000						
(9) Cash	0.324	0.289	0.332	0.253	0.288	0.430	0.403	0.066	1.000					
(10) Equity_Issuance	0.256	0.238	0.077	**0.012**	0.092	0.248	0.154	-0.053	0.139	1.000				
(11) Net Leverage	-0.298	-0.222	-0.276	-0.250	-0.354	-0.465	-0.451	**-0.010**	-0.655	-0.149	1.000			
(12)Exec_Confidence	0.015	0.041	-0.022	**-0.012**	**-0.007**	0.017	**0.007**	**0.004**	**0.005**	**0.007**	**-0.010**	1.000		
(13) Exec_Payratio	0.084	0.086	0.038	0.068	0.098	0.079	0.096	0.043	0.087	0.063	-0.125	0.000	1.000	
(14) SubEx_ConAbl	0.070	0.090	**0.011**	0.039	0.064	0.068	0.073	0.033	0.065	0.049	-0.095	0.707	0.707	1.000

Panel B: Univariate analysis

Quintile (by SubEx_ConAl)	Observations	Mean_ROA_Vol	Mean_CF_Vol
Q1 (Low)	2,682	0.0383	0.0599
Q5 (High)	2,681	0.0458	0.0611
Q5-Q1 (High – Low)		**0.0075*** **	**0.0012*** **

Notes: In Panel A all corelations but the bold ones are significant at least at 10% or better. Panel B presents our univariate mean difference analysis. *** represents significance at 1% level. Appendix A.1 provides a detailed description of the variables.

Table 3: Impact of subordinate executives' confidence and ability on corporate risk-taking

Panel A: Baseline results

VARIABLES	(1) ROA_Vol	(2) ROA_Vol	(3) ROA_Vol	(4) CF_Vol	(5) CF_Vol	(6) CF_Vol
SubEx_ConAbl	**0.0292*** **			**0.0375*** **		
	(0.006)			**(0.007)**		
Exec_Confidence		0.0120**			0.0190**	
		(0.006)			(0.007)	
Exec_Payratio			0.1549***			0.1814***
			(0.033)			(0.038)
Sales Growth	0.1596***	0.1601***	0.1601***	-0.0065	-0.0060	-0.0059
	(0.042)	(0.042)	(0.042)	(0.046)	(0.046)	(0.046)
MB Ratio	0.0138***	0.0139***	0.0137***	0.0080***	0.0082***	0.0080***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Annual Return	0.0118	0.0104	0.0143	0.0933***	0.0913***	0.0962***
	(0.017)	(0.017)	(0.017)	(0.020)	(0.020)	(0.020)
Firm Size	-0.1986***	-0.1966***	-0.1979***	-0.1520***	-0.1495***	-0.1508***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Log(Firm_Age)	-0.1168***	-0.1215***	-0.1154***	-0.0972***	-0.1032***	-0.0962***
	(0.025)	(0.025)	(0.025)	(0.028)	(0.028)	(0.028)
Leverage	0.0217	0.0149	0.0226	0.4337***	0.4252***	0.4339***
	(0.087)	(0.087)	(0.087)	(0.092)	(0.093)	(0.093)
distress	0.1545**	0.1547**	0.1527**	0.2946***	0.2951***	0.2924***
	(0.069)	(0.069)	(0.069)	(0.079)	(0.079)	(0.080)
CEO Delta	0.0495***	0.0459***	0.0447***	-0.0628***	-0.0667***	-0.0692***
	(0.017)	(0.017)	(0.017)	(0.019)	(0.020)	(0.019)
CEO Vega	0.0112	0.0094	0.0148	0.0371***	0.0344***	0.0412***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
CEO Age	-0.0995	-0.1029	-0.0991	-0.2934**	-0.2976**	-0.2933**
	(0.120)	(0.120)	(0.120)	(0.138)	(0.138)	(0.138)
CEO Tenure	-0.0054**	-0.0054**	-0.0053**	-0.0048*	-0.0048*	-0.0047*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Share_Ownership	-0.9834**	-0.8341*	-0.9449**	0.5228	0.6998	0.5898
	(0.468)	(0.470)	(0.468)	(0.490)	(0.493)	(0.490)
Board Size	-0.0114	-0.0104	-0.0118	0.0007	0.0019	0.0003
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Independent Board	-0.0229	-0.0298	-0.0202	0.0087	-0.0001	0.0110
	(0.027)	(0.027)	(0.027)	(0.030)	(0.030)	(0.030)
Observations	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.290	0.289	0.290	0.229	0.227	0.229
Industry and Year FE	YES	YES	YES	YES	YES	YES

Panel B: Importance of SubEx_ConAbl over Exec_Horizon

VARIABLES	(1) High SubEx_ConAbl ROA_Vol	(2) Low SubEx_ConAbl ROA_Vol	(3) High SubEx_ConAbl CF_Vol	(4) Low SubEx_ConAbl CF_Vol
Exec_Horizon	**0.0098****	-0.0036	**0.0169*****	0.0045
	(0.004)	(0.005)	**(0.005)**	(0.005)
Observations	4,469	4,470	4,469	4,470
Adjusted R-squared	0.311	0.273	0.251	0.213
Industry and Year FE	YES	YES	YES	YES

Notes: **Panel A** presents regression results investigating the relation between SubEx_ConAbl and corporate risk-taking proxies. From column (1) to (3), the dependent variable is the measure of return on assets volatility (ROA_Vol) and from column (4) to (6), the dependent variable is cash flow volatility (CF_Vol). The independent variables are subordinate executives' confidence and ability (SubEx_ConAbl), executives' confidence ratio (Exec_Confidence), and executive pay ratio (Exec_Payratio) in columns (1) to (6) respectively. **Panel B** presents the relative importantance of *SubEx_ConAbl* in corporate risk-taking over *Exec_Horizon* that was used in Mekhaimer et al. (2022). A constant term is included in all models but is omitted for brevity. The definitions of all variables are provided in the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Impact of *SubEx_ConAbl on* corporate investment and financing policies, and their channelling effects

Panel A: Impact of *SubEx_ConAbl on* corporate investment and financing policies

VARIABLES	(1) CAPX	(2) R&D	(3) Intangibles	(4) Advertising	(5) Cash	(6) Equity Issuance	(7) Net Leverage
SubEx_ConAbl	0.2377**	0.1738***	0.2156***	0.0535**	0.2655***	0.1531**	-1.0902***
	(0.100)	(0.040)	(0.056)	(0.025)	(0.079)	(0.062)	(0.217)
Observations	13,408	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.334	0.459	0.445	0.288	0.301	0.119	0.373
Controls	YES	YES	YES	YES	YES	YES	YES
Industry & Year FE	YES	YES	YES	YES	YES	YES	YES

Panel B: Channeling effects

VARIABLES	(1) ROA_Vol	(2) ROA_Vol	(3) ROA_Vol	(4) ROA_Vol	(5) CF_Vol	(6) CF_Vol	(7) CF_Vol	(8) CF_Vol
SubEx_ConAbl	0.0292***	0.0221***	0.0208***	**0.0172*** **	0.0359***	0.0286***	0.0302***	**0.0260*** **
	(0.006)	(0.006)	(0.006)	**(0.006)**	(0.007)	(0.007)	(0.007)	**(0.007)**
CAPX		0.2206**		0.0991		0.1271		0.0795
		(0.094)		(0.092)		(0.109)		(0.106)
Intangibles		2.9269***		2.4898***		2.8392***		2.5185***
		(0.222)		(0.217)		(0.265)		(0.260)
Advertising		0.9193*		0.8658		1.4249**		1.4399**
		(0.530)		(0.526)		(0.606)		(0.602)
Cash			1.1037***	0.9440***			1.4043***	1.2343***
			(0.150)	(0.139)			(0.165)	(0.157)
Equity_Issuance			0.9730***	0.8283***			1.3371***	1.1955***
			(0.125)	(0.112)			(0.130)	(0.120)
NetLeverage			-0.2260***	-0.1110*			0.1103	0.2274***
			(0.071)	(0.066)			(0.076)	(0.072)
Channeling Effect		0.0071***	0.0084***	0.0120***		0.0073***	0.0057***	0.0099***
Coef. comp. p-value		0.000	0.000	0.000		0.000	0.000	0.000
% of total effect channeled		24.32%	28.76%	41.10%		20.33%	15.88%	27.58%
Observations	13,408	13,392	13,355	13,339	13,408	13,392	13,355	13,339
Adjusted R-squared	0.290	0.334	0.323	0.352	0.224	0.259	0.253	0.279
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Notes: **Panel A** reports regression results investigating the relation between *SubEx_ConAbl* and the firm's investment and financing policies. The dependent variables are the measure of capital expenditures (CAPX), research and development expenditure (R&D), intangible capital (Intangibles), advertising expenditures (Advertising), cash holing (Cash), equity issuance, and net leverage from columns (1) to (7) respectively. The independent variable is the measure of *SubEx_ConAbl*. **Panel B** reports regression results examining the moderating effect of investment and financing policies on a firm's overall risk-taking. The dependent variable is the return on assets volatility (ROA_Vol) and cash flow volatility (CF_Vol) respectively. The channeling effect is the reduction in the effects of *SubEx_ConAbl* on ROA_Vol and CF_Vol. The effect is estimated as the change in the coefficient estimates of *SubEx_ConAbl* from the respective values reported in column (1). The control variables are similar to those in our baseline model; except that leverage is removed to be consistent across all the models and to investigate the cleaner channeling effect of investment and financing decisions.A constant term is included in all models but is omitted for brevity. The definitions of all variables are provided in the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Addressing endogeneity concerns

Panel A: : Instrumental variable approach, difference-in-difference (DiD) test, and use of firm fixed effects

VARIABLES	(1) 2SLS SubEx_ConAbl	(2) 2SLS ROA_Vol	(3) 2SLS CF_Vol	(4) DID ROA_Vol	(5) DID CF_Vol	(6) Firm FE ROA_Vol	(7) Firm FE CF_Vol
No. of Named Executive	0.1002***						
	(0.016)						
Predicted SubEx_ConAbl		**0.4881*** **	**0.6332*** **				
		(0.124)	**(0.149)**				
Exec_Optionratio				0.0120**	0.0190**		
				(0.006)	(0.007)		
Exec_Payratio				0.1514***	0.1768***		
				(0.032)	(0.038)		
CID_FIRM				-0.0360	-0.0387		
				(0.036)	(0.040)		
POST_CID_FIRM				**0.0627** **	**0.0837*** **		
				(0.027)	**(0.031)**		
SubEx_ConAbl						**0.0146*** **	**0.0146** **
						(0.005)	**(0.006)**
Observations	13,408	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.068	-0.431	-0.699	0.291	0.230	0.619	0.585
Controls	YES	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES		
Cragg-Donald Wald F statistic		60.21	60.21				
Test for Endogeneity (p-value)		0.00	0.00				
Firm and Year FE						YES	YES

Panel B: Test for omitted variable bias using Oster (2019)

Oster Condition	Variable of interest	ROA_Vol			CF_Vol		
		Lower Bound	Upper Bound	Includes Zero?	Lower Bound	Upper Bound	Includes Zero?
Assume d=1; RMAX=min(1.25$\tilde{R}$,1)	SubEx_ConAbl	0.0235	0.0292	NO	0.0305	0.0375	NO
Assume d=1; RMAX=min(1.5$\tilde{R}$,1)	SubEx_ConAbl	0.0178	0.0292	NO	0.0234	0.0375	NO
Assume d=1; RMAX=min(1.8$\tilde{R}$,1)	SubEx_ConAbl	0.0110	0.0292	NO	0.0150	0.0375	NO
Assume d=1; RMAX=min(2.2$\tilde{R}$,1)	SubEx_ConAbl	0.0019	0.0292	NO	0.0037	0.0375	NO

Panel C: Baseline results with propensity score matching (PSM) and entropy balancing (EB) samples

	PSM Sample		EB Sample	
	(1)	(2)	(3)	(4)
VARIABLES	ROA_Vol	CF_Vol	ROA_Vol	CF_Vol
SubEx_ConAbl	**0.0290*** (0.006)**	**0.0360*** (0.008)**	**0.0284*** (0.006)**	**0.0354*** (0.007)**
Observations	8,082	8,082	13,408	13,408
Adjusted R-squared	0.291	0.232	0.304	0.243
Controls	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES

Notes: **Panel A** presents regression results addressing the endogeneity. Column (1) represents the first stage results where the number of named executives is the independent variable and *SubEx_ConAbl* is the dependent variable. From columns (2) to (3), the independent variable is the predicted *SubEx_ConAbl* . In column (4), CID_FIRM is an indicator equal to 1 if the firm has at least one key executive who holds independent directorships in other firms during the sample period, and 0 otherwise. In column (5), POST_CID_FIRM is an indicator equal to 1 for firm years after the key executive is appointed as an independent director in other firms, and 0 otherwise. From columns (6) to (7), the independent variables are subordinate executives' confidence and ability (*SubEx_ConAbl).* From columns (2) to (7), the dependent variables are the returns on assets volatility (ROA_Vol) and cash flow volatility (CF_Vol) used alternatively. **Panel B** presents the summary of Oster (2019) test outcome on different Oster (2019) conditions, and corresponding upper and lower bounds for our key independent variable *SubEx_ConAbl* relating both of our dependent variables ROA_Vol and CF_Vol. **Panel C** reports the re-estimation of our baseline results using Propensity Score Matched (PSM) and Entropy Balanced (EB) samples. The diagnostics of PSM sample and proof of convergence of EB sample are reported in the Appendix. A constant term is included in all models but is omitted for brevity. The definitions of all variables are in provided the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Additional robustness checks

Panel A: Summary of the robustness tests

VARIABLES	(1) ROA_Vol	(2) CF_Vol	(3) CAPX	(4) R&D	(5) Intangibles	(6) Advertising	(7) Cash	(8) Equity Issuance	(9) Net Leverage
(1) Abnormal compensation	0.0515***	0.0613***	0.6033***	0.3747***	0.2972***	0.0838***	0.5593***	0.2221***	-1.3198***
	(0.007)	(0.008)	(0.107)	(0.049)	(0.065)	(0.025)	(0.098)	(0.064)	(0.245)
(2) Option ratio scaled by total assets	0.0855***	0.0952***	0.7964***	0.6186***	0.8253***	0.0732***	0.9261***	0.6797***	-2.4900***
	(0.008)	(0.009)	(0.122)	(0.076)	(0.090)	(0.028)	(0.118)	(0.111)	(0.277)
(3) Log of SubEx_Comp	0.0608***	0.0704***	0.6874***	0.3681***	0.5258***	0.0890***	0.6484***	0.2018***	-1.7632***
	(0.008)	(0.009)	(0.115)	(0.054)	(0.070)	(0.028)	(0.107)	(0.075)	(0.274)
(4) Option ratio using moneyness	0.0377***	0.0417***	0.3206***	0.1532***	0.1691***	0.0832***	0.2867***	0.1568**	-1.0088***
	(0.006)	(0.007)	(0.101)	(0.038)	(0.056)	(0.025)	(0.081)	(0.064)	(0.212)
(5) Median measures	0.0259***	0.0290***	0.2754***	0.1450***	0.1585***	0.0486*	0.2265***	0.1674***	-1.0310***
	(0.006)	(0.007)	(0.104)	(0.041)	(0.056)	(0.027)	(0.082)	(0.061)	(0.227)
(6) Excluding overconfident SubEx	0.0234***	0.0267***	0.1823**	0.1230***	0.1729***	0.0478**	0.2110***	0.1427***	-0.8472***
	(0.005)	(0.005)	(0.082)	(0.029)	(0.045)	(0.021)	(0.062)	(0.048)	(0.166)

Panel B: Alternative measures of risk-taking

VARIABLES	(1) RET_Vol	(2) Idiosyncratic_Vol	(3) Systematic_Vol	(4) Opasset_Vol
SubEx_ConAbl	**0.0085*** **	**0.0029*** **	**0.0051*** **	**0.0126*** **
	(0.002)	**(0.001)**	**(0.003)**	**(0.004)**
Observations	13,373	13,373	13,361	13,366
Adjusted R-squared	0.600	0.505	0.252	0.541
Controls	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES

Notes: **Panel A** presents the summary of baseline results using several alternative measures of our key independent variable (SubEx_ConAbl) and relatedly internal or bottom-up corporate governance. Subordinate executives' abnormal compensation is the residual from a regression of executives' mean total compensation on known determinants of CEO pay (log(lagged sales), S&P 500 membership, lagged book-to-market, returns and lagged returns, ROA and lagged ROA, and industry and year fixed effects). Moneyness is measured as the difference between fiscal end year price and the ratio of the unexercised exercisable option value to the number of unexercised exercisable options. Median measures use the median values of subordinate executives' pay ratio and confidence ratio. Overconfident subordinate executives (overconfident SubEx) are those executives who hold more than 67% of unexercised exercisable in the money options and whose tenure is more than four years. The option value is calculated as the ratio of the unexercised exercisable option value to the number of unexercised exercisable options scaled by the fiscal year-end price. The dependent variables are the measure of capital expenditures (CAPX), research and development expenditure (R&D), intangible capital (Intangibles), advertising expenditures (Advertising), cash holing (Cash), equity issuance, and net leverage from columns (1) to (7) respectively. **Panel B** presents regression results investigating the relation between SubEx_ConAbl and firm risk-taking using alternative proxies for risk-taking measures. The dependent variables are the measures of return volatility

(RET_Vol), idiosyncratic volatility (Idiosyncratic_Vol), systematic volatility (Systematic_Vol), and operating assets volatility (Opasset_Vol). Return volatility is annualized standard deviation of daily stock return. Idiosyncratic risk is estimated as the log of the annualized standard deviation of the error term obtained from the market model where daily stock returns are regressed on daily market return in each year. Systematic volatility is the coefficient of daily market return using the same market model as used to estimate idiosyncratic risk. Operating assets volatility is calculated following Gormley and Matsa (2016). Operating assets is measured as stock volatility ×[E / (V −C)], where E / (V −C) is calculated from Compustat using (csho ×prcc_f) / [lt + (csho ×prcc_f) −ch].The independent variable is the measure of *SubEx_ConAbl*.A constant term is included in all models but is omitted for brevity. The definitions of all other variables are provided in the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Cross-sectional tests

Panel A: Role of market competition/external governance

VARIABLES	(1) ROA_Vol	(2) CF_Vol	(3) CAPX	(4) R&D	(5) Intangibles	(6) Advertising	(7) Cash	(8) Equity Issuance	(9) Net Leverage
SubEx_ConAbl*HHI(Low)	0.0197*	0.0311***	0.3648**	0.1769***	0.1778**	-0.0049	0.1263	0.2045**	-0.5620
	(0.011)	(0.011)	(0.171)	(0.055)	(0.075)	(0.051)	(0.109)	(0.098)	(0.343)
SubEx_ConAbl*HHI(Medium)	0.0334***	0.0331***	0.2584*	0.1226**	0.2144**	0.0613*	0.2697**	0.0822	-1.4174***
	(0.010)	(0.012)	(0.138)	(0.053)	(0.083)	(0.037)	(0.126)	(0.103)	(0.333)
SubEx_ConAbl*HHI(High)	0.0342***	0.0478***	0.0948	0.2209***	0.2530***	0.1022***	0.3943***	0.1737	-1.2691***
	(0.010)	(0.012)	(0.179)	(0.073)	(0.095)	(0.033)	(0.138)	(0.107)	(0.319)
HHI(Medium)	0.0334	0.0310	-0.2878	-0.0784	0.1170	0.0334	0.1498	0.1887	1.4799**
	(0.024)	(0.028)	(0.328)	(0.118)	(0.167)	(0.071)	(0.289)	(0.236)	(0.700)
HHI(High)	-0.0627**	-0.0359	-0.1212	-0.0460	0.0057	0.0762	-0.2922	0.0483	1.6825*
	(0.031)	(0.037)	(0.441)	(0.147)	(0.223)	(0.101)	(0.381)	(0.278)	(0.917)
Observations	13,408	13,408	13,408	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.291	0.229	0.334	0.459	0.445	0.289	0.301	0.118	0.373
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel B: Role of firm complexity

VARIABLES	(1) ROA_Vol	(2) CF_Vol	(3) CAPX	(4) R&D	(5) Intangibles	(6) Advertising	(7) Cash	(8) Equity Issuance	(9) Net Leverage
SubEx_ConAbl*Firm_Complexity(Low)	0.0199*	0.0245**	0.1787	0.1600**	0.1344	-0.0115	0.1221	0.2296*	-1.2787***
	(0.011)	(0.012)	(0.202)	(0.078)	(0.108)	(0.054)	(0.146)	(0.120)	(0.388)
SubEx_ConAbl*Firm_Complexity(Medium)	0.0141	0.0183	0.1510	0.1379**	0.1181	0.0831**	0.2435*	0.1174	-0.3669
	(0.011)	(0.012)	(0.165)	(0.059)	(0.095)	(0.040)	(0.128)	(0.101)	(0.382)
SubEx_ConAbl*Firm_Complexity(High)	0.0429***	0.0563***	0.2382	0.1995***	0.3081***	0.0991**	0.3816***	0.2408**	-1.3742***
	(0.012)	(0.013)	(0.151)	(0.057)	(0.076)	(0.044)	(0.108)	(0.106)	(0.328)
Firm_Complexity(Medium)	-0.1569***	-0.1207**	-1.3230**	-0.5407**	-0.8688**	-0.2012	-0.3756	-0.2155	11.1990***
	(0.043)	(0.047)	(0.608)	(0.250)	(0.371)	(0.155)	(0.537)	(0.331)	(1.473)
Firm_Complexity(High)	0.0710	0.1349*	0.3492	0.4354	0.7495	0.0210	1.7857**	1.3754**	8.6217***
	(0.071)	(0.074)	(0.931)	(0.454)	(0.628)	(0.270)	(0.902)	(0.604)	(2.513)
Observations	11,851	11,851	11,851	11,851	11,851	11,851	11,851	11,851	11,851
Adjusted R-squared	0.296	0.232	0.343	0.453	0.449	0.294	0.308	0.122	0.384
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel C: Role of subordinate executives' experience

VARIABLES	(1) ROA_Vol	(2) CF_Vol	(3) CAPX	(4) R&D	(5) Intangibles	(6) Advertising	(7) Cash	(8) Equity Issuance	(9) Net Leverage
SubEx_ConAbl*Experience (Low)	0.0371***	0.0442***	0.2655*	0.2887***	0.3515***	0.0761**	0.2805**	0.2377**	-1.0125***
	(0.009)	(0.010)	(0.150)	(0.062)	(0.087)	(0.038)	(0.111)	(0.103)	(0.329)
SubEx_ConAbl*Experience (Medium)	0.0385***	0.0432***	0.2639	0.1668***	0.2223***	0.0671**	0.1067	0.0038	-1.0858***
	(0.009)	(0.012)	(0.164)	(0.058)	(0.081)	(0.032)	(0.125)	(0.089)	(0.310)
SubEx_ConAbl*Experience (High)	0.0058	0.0195	0.1553	0.0029	-0.0055	0.0007	0.4271***	0.1969*	-1.2183***
	(0.011)	(0.012)	(0.164)	(0.061)	(0.085)	(0.045)	(0.147)	(0.108)	(0.375)
Experience (Medium)	-0.0449*	-0.1238***	-1.4672***	-0.1224	-0.3157	-0.3246***	-0.5568*	-0.4130*	-0.5739
	(0.024)	(0.027)	(0.361)	(0.156)	(0.225)	(0.095)	(0.319)	(0.212)	(0.802)
Experience (High)	-0.0723**	-0.2535***	-1.8264***	-0.5889***	-0.7481***	-0.3752***	-0.9521**	-0.3225	-0.6442
	(0.032)	(0.036)	(0.436)	(0.199)	(0.283)	(0.119)	(0.400)	(0.239)	(1.083)
Observations	13,408	13,408	13,408	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.291	0.238	0.337	0.462	0.447	0.291	0.302	0.119	0.373
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: **Panel A** presents regression results investigating the impact of product market competition on the relation between *SubEx_ConAbl* and corporate risk-taking, firm's investment, and financing policies. HHI is measured as the sum of the squares of the percentage market share of firms in the Fama & French 48 industry. HHI (Low) to HHI (High) is measured based on the HHI tercile. **Panel B** presents regression results investigating the impact of firm complexity on the relation between *SubEx_ConAbl* and corporate risk-taking, firm's investment, and financing policies. Firm complexity is the principal component of the number of geographical segments, firm size, and R&D expenditure. Firm_Complexity(Low) to Firm_Complexity (High) is measured based on the tercile value of Firm_Complexity. **Panel C** presents regression results investigating the impact of subordinate executives' experience on the relation between *SubEx_ConAbl* and corporate risk-taking, firm's investment, and financing policies. Experience is the industry-adjusted measure of tenure and age. Experience(Low) to Experience(High) is measured based on the tercile value of the Experience measure. The dependent variables in all three panels are the measure of capital expenditures (CAPX), research and development expenditure (R&D), intangible capital (Intangibles), advertising expenditures (Advertising), cash holing (Cash), equity issuance, and net leverage from columns (1) to (7) respectively. The independent variable is the measure of *SubEx_ConAbl*. A constant term is included in all models but is omitted for brevity. The definitions of all variables are proved in the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Additional Aaalyses

Panel A: SubEx_ConAbl, firm value, and innovation efficiency

VARIABLES	(1) Tobin's Q	(2) Gross Margin	(3) Patent	(4) Citation	(5) Citation/Patent	(6) Patent Value
SubEx_ConAbl	**4.1463*** **	**0.4676*** **	**0.0104**	**0.0329***	**0.0200** **	**0.0284***
	(0.817)	**(0.154)**	**(0.011)**	**(0.017)**	**(0.009)**	**(0.017)**
Observations	13,408	13,408	13,408	13,408	13,408	13,408
Adjusted R-squared	0.421	0.343	0.501	0.477	0.378	0.529
Controls	YES	YES	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES	YES	YES

Panel B: Role of CEO power and overconfidence

VARIABLES	(1) ROA_Vol	(2) CF_Vol	(3) ROA_Vol	(4) CF_Vol
SubEx_ConAbl	0.0319***	0.0430***	0.0332***	0.0409***
	(0.007)	(0.008)	(0.006)	(0.007)
SubEx_ConAbl*CEO_power	**-0.0343** **	**-0.0269***		
	(0.015)	**(0.016)**		
High CEO_power	-0.0118	0.0152		
	(0.021)	(0.023)		
SubEx_ConAbl*Overconfident_CEO			**-0.0543** **	**-0.0443**
			(0.024)	**(0.027)**
Overconfident_CEO			-0.0104	0.0520
			(0.049)	(0.058)
Observations	13,408	13,408	13,408	13,408
Adjusted R-squared	0.289	0.228	0.291	0.229
Controls	YES	YES	YES	YES
Industry and Year FE	YES	YES	YES	YES

Notes: **Panel A** presents regression results investigating the impact of *SubEx_ConAbl* on a firm's valuation and innovation efficiency. We use *Tobin's Q* and *Gross Margin* as the proxies for firm valuation (reported in columns 1 and 2, respectively). The dependent variables that reflect innovation efficiency are the measure of patents, citations, citation/patents, and patent value (reported in columns 3 to 6, respectively). **Panel B** reports regression results investigating the role of CEO power and overconfidence within the relation between *SubEx_ConAbl* and corporate risk-taking. CEO power is a dummy variable equal to one if the CEO power is greater than the sample top tercile power index. CEO power index is the sum of CEO duality, CEO tenure dummy, CEO share ownership dummy, CEO founder dummy, CEO pay slice, dependent executives dummy, CEO only insider dummy, and CEO connection with independent director dummy. Overconfident_CEO is equal to one if the CEO tenure is greater than or equal to five and holds more than 67% of options at least twice during the CEO tenure. Option ratio is the ratio of the value of unexercised but

exercisable options to the number of unexercised but exercisable options, scaled by the fiscal-year-end stock price. A constant term is included in all models but is omitted for brevity. The definitions of all variables are provided in the Appendix. Robust standard errors adjusted for heteroskedasticity and clustered at the firm level are reported in brackets below the coefficients. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix A1: Variable Definitions

Dependent Variable	Variable definitions
ROA_Vol	Return on assets (ROA) volatility is the five-year rolling standard deviation of ROA. ROA is the ratio of EBIT to total assets.
CF_Vol	Cash flow volatility is the five-year rolling standard deviation of cash flow. Cash flow is measured as the sum of net income and depreciation scaled by total assets
Tobin's Q	(Fiscal annual closed price * common shares outstanding + total assets - total common equity)/ total assets
Gross Margin	(Sales-COGS)/sales
CAPX	The ratio of capital expenditure to property, plant, and equipment.
R&D	Research and development expenditure scaled by total assets
Intangibles	Research and development expenditure plus 30% of sales, general and administrative (SG&A) expenses, scaled by total assets following (Peters and Taylor, 2017)
Advertising	The ratio of advertising expenditure to sales
Cash	The ratio of cash to total assets
Equity Issuance	(changes in common equity – changes in retained earnings)/total assets following (Gong, 2020)
Net Leverage	(dltt+dlc-che)/at following (Gopalan and Kalda, 2021)
Independent Variable	
Exec_Confidence	Subordinate executives' average confidence/CEO's confidence. Confidence is estimated as (OPT_UNEX_EXER_EST_VAL/ OPT_UNEX_EXER_NUM)/PRCC_F
Exec_Payratio	The subordinate executives' pay ratio is calculated as the average total compensation of subordinate executives scaled by the CEO's total compensation.
SubEx_ConAbl	A firm's overall *SubEx_ConAbl* is measured as the sum of the standardized value of Exec_ Confidence and Exec_Payratio.
Control Variables	
Sales Growth	(Current year sales-prior year sales)/prior-year sales
MB Ratio	(Fiscal annual closed price * common shares outstanding)/ Shareholders' equity
Annual Return	Annualized monthly stock returns
Firm Size	Log of the total book value of assets
Firm age	Firm age is defined as the natural log of (1 + the number of years since incorporation)
Leverage	Short-term debt plus long-term debt, scaled by total assets
Tangibility	Net PP&E scaled by total assets
SubEx_Vega	Expected average dollar change in subordinates' wealth for a 1% change in stock sensitivity price.

SubEx_Vega	Expected average dollar change in subordinates' wealth for a 0.01 change in stock return volatility
CEO Delta	Expected dollar change in the CEO's wealth for a 1% change in stock sensitivity price.
CEO Vega	Expected dollar change in the CEO's wealth for a 0.01 change in stock return volatility.
CEO age	Age of the CEO
CEO Tenure	Number of years serving as a CEO in the firm
Share_Ownership	The proportion of shares held by the CEO
Board Size	Number of board members
Board Independence	Number of independent directors/board size

Appendix A2: Proof of propensity score matching (PSM) indifference

Variables	Treatment	Controls	Diff	P-value
Sales Growth	0.108	0.111	-0.0029	0.5585
MB Ratio	3.359	3.337	0.0219	0.8292
Annual Return	0.19	0.191	-0.0004	0.9646
Firm Size	7.456	7.452	0.0037	0.9168
Log(Firm_Age)	3.069	3.068	0.0012	0.9340
Leverage	0.211	0.211	0.0000	0.9979
Distress	0.051	0.054	-0.0027	0.5836
CEO Delta	5.575	5.578	-0.0031	0.9185
CEO Vega	4.171	4.173	-0.0021	0.9478
CEO Age	4.008	4.007	0.0008	0.7821
CEO Tenure	7.78	7.769	0.0111	0.9443
Share_Ownership	0.016	0.016	-0.0002	0.7793
Board Size	9.145	9.14	0.0047	0.9251
Independent Board	0.531	0.533	-0.0022	0.8410

Notes: This appendix provides supportive evidence for the analysis reported in columns 1 and 2 of Panel C of Table 5.

Appendix A3: Proof of entropy balancing (EB) convergence

Panel A: Before balancing

	Treatment			Controls		
Variables	Mean	Variance	Skewness	Mean	Variance	Skewness
Sales Growth	0.109	0.0505	1.38	0.1019	0.042	1.559
MB Ratio	3.306	19.57	2.411	3.521	22.61	2.236
Annual Return	0.1913	0.2161	1.364	0.1929	0.1797	1.369
Firm Size	7.36	2.764	0.4641	7.768	2.402	0.3226
Log(Firm_Age)	3.042	0.4502	-0.1774	3.211	0.4661	-0.4155
Leverage	0.205	0.0359	0.9513	0.2311	0.0330	0.7786
Distress	0.0526	0.0498	4.011	0.04188	0.0401	4.574
CEO Delta	5.529	2.215	0.5373	5.866	1.558	0.3583
CEO Vega	4.024	2.403	-0.2512	4.57	1.973	-0.6178
CEO Age	4.006	0.0199	-0.2254	4.018	0.0142	-0.2604
CEO Tenure	7.7982	58.18	1.774	7.854	42.69	2.048
Share_Ownership	0.0207	0.0022	3.342	0.0123	0.0010	4.879
Board Size	9.108	5.383	0.5727	9.351	4.722	0.4248
Independent Board	0.4938	0.25	0.02487	0.6593	0.47	-0.6721

Panel B: After balancing

	Treatment			Controls		
Variables	Mean	Variance	Skewness	Mean	Variance	Skewness
Sales Growth	0.109	0.0505	1.38	0.109	0.0475	1.569
MB Ratio	3.306	19.57	2.411	3.307	18.7	3.215
Annual Return	0.1913	0.2161	1.364	0.1913	0.2119	1.331
Firm Size	7.36	2.764	0.4641	7.36	2.341	0.0485
Log(Firm_Age)	3.042	0.4502	-0.1774	3.042	0.4786	-0.2153
Leverage	0.205	0.0359	0.9513	0.205	0.0322	0.847
Distress	0.0526	0.0498	4.011	0.0525	0.0498	4.011
CEO Delta	5.529	2.215	0.5373	5.529	1.831	0.4158
CEO Vega	4.024	2.403	-0.2512	4.024	2.251	-0.4941
CEO Age	4.006	0.0199	-0.2254	4.006	0.0167	-0.1731
CEO Tenure	7.7982	58.18	1.774	7.7982	53.03	2.079
Share_Ownership	0.0207	0.0022	3.342	0.0207	0.0024	3.331
Board Size	9.108	5.383	0.5727	9.108	4.914	0.5555
Independent Board	0.4938	0.25	0.02487	0.4939	0.25	0.0244

Notes: This appendix provides supportive evidence for the analysis reported in columns 3 and 4 of Panel C of Table 5.