Essays in corporate risk

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Essays in Corporate Risk

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TILBURG UNIVERSITY

Essays in Corporate Risk

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op gezag van de rector magnificus, prof. dr. W.B.H.J. van de Donk, in

het openbaar te verdedigen ten overstaan van een door het college voor

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door

Ke Wang,

geboren te Hainan, China

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Acknowledgments

My PhD journey has been a long and dedicated effort to pursue knowledge. This journey took me across numerous cities and involved countless hours of research. It was motivated by the meaning of my name, “Ke”, which my parents and grandparents gave me, signifying a lifelong commitment to contribute to scientific understanding. Each time I engaged in my research, their words reminded me of the importance of science—not just to our family, but to society as a whole.

The first year of my journey involved traveling 2,000 kilometers between Guangzhou and Beijing every month, diving deep into the intricacies of finance theories. In subsequent years, I conducted research while discussing my work with professors in the Netherlands and gaining real-world finance and investment experience in many cities including Haikou, Wuhan, Shenzhen, Singapore, and Hong Kong. Each city was like a new classroom for me, with each location enriching my academic journey. Earning my PhD was not easy at all. It involved overcoming many challenges and learning from mistakes. I had to painstakingly collect thousands of texts by hand, run numerous regression tests, immerse myself in volumes of books, experiment with various research methods, and participate in international conferences. But these were not obstacles to me, they were stepping stones - each challenge made me more resilient and determined, enabling me to learn from failure and persist in pursuing my goals.

I am deeply grateful to my PhD supervisors for their role in this journey. Prof. Rachel Pownall, an expert in investor behavior and risk management, gave me unwavering confidence in my abilities through her extensive knowledge and steady patience. Her influence was key in navigating the demanding process of research and self-discovery. Prof. Liqing Zhang, an accomplished academic and economist, was a consistent source of inspiration, pushing me to work harder and set higher goals. Prof. Cong Xia has a special place in my thanks. His expertise in causal analysis and corporate finance, together with his detailed and thoughtful guidance, became fundamental to my academic development. Their collective commitment, wise counsel, and dedication to furthering my professional growth were instrumental in shaping my identity as a researcher.

I extend my deepest gratitude to the esteemed members of my PhD committee: Prof. Dirk Brounen, Prof. Peter de Goeij, Prof. Dakshina G. De Silva, Prof. Stefanie Kleimeier. Their intellectual insights, particularly in theoretical research, have been valuable in guiding the development of my research journey. I am also thankful for the wonderful professors at Tilburg and CUFE, including Ben Jacobsen, Frans de Roon, Bart Frijns, Jian Li, Jianjun Li, Xueyong Zhang, Zhigang Huang, Xian Gu, Xu Wei, Ya Ma. Their enriching teachings expanded my academic horizons. I must thank Ying Zhang, Ting Jiang, Cecile de Bruijn, Ank Habraken, and other diligent faculty members for their tireless administrative support along the way. And to my fellow PhD students, including Zhenshu Wu, Zili Su, Wei Yao, Fang Sun, Benchao Wang, Xiujun Li and others - thank you for the camaraderie and encouragement that aided my personal development immensely.

My family has been at the core of this journey. My parents, sister, and uncle gave me unwavering support, constant encouragement, and confidence in my abilities - pillars of strength that drove my efforts forward. Their assistance, financial and inspirational, set a powerful example of hard work and family dedication that shaped my work ethic and commitment to our family's growth. My wife, Xiaorui Tang, has been a steady source of support and encouragement, strongly fueling my determination and empowering my journey. Our shared passion for academic research and truth has bonded us. Her talent and knowledge in data science have been a consistent inspiration, influencing my own research work. Her patience and calm manner taught me the importance of staying composed in research, inspiring me to maintain balance in my work. And finally, my two-year-old son, Junyuan Wang, has been an endless source of joy and motivation, always reminding me of the wonder of discovery and the value of perseverance.

This journey, lasting over six years and motivated by my commitment to science represented in my name “Ke”, finds its completion in this thesis. However, this thesis marks not an ending, but a beginning to a new era of constant questioning and exploration. I sincerely hope that this work, a small contribution to the vast ocean of scientific knowledge, will add to our collective understanding and spark others' curiosity to embark on their own voyages of discovery.

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Chapter 1 Introduction

Managing risk is of paramount importance in corporate finance. However, despite the increasing significance of corporate risk, limited research has systematically examined the causes of corporate risks, including Environmental, Social and Governance (ESG) reputational risk, general corporate risk, stock price crash risk, etc. This PhD thesis aims to answer the research question of what factors determine these corporate risks. The thesis comprises three independent research chapters, each focusing on a different corporate risk. The first two chapters adopt the regression discontinuity design (RDD) methodology to investigate the causal impact of CEO career concerns on general corporate risk and ESG reputational risk. These chapters demonstrate the significant role of CEO career concerns in reducing general corporate risk and ESG reputational risk. The third chapter investigates the effect of a higher level of director nomination eligibility criteria (DNEC) on stock price crash risk, demonstrating why implementing a higher level of DNEC results in a reduced Stock Price Crash risk.

1. General corporate risk

Chapter 2 demonstrates that CEO career concerns lead to risk aversion. Theoretical literature suggests that career concerns may serve as an implicit incentive, motivating CEOs to alter their risk preferences, ultimately leading to varying corporate risks (Fama, 1980; Frydman and Jenter, 2010; Gibbons and Murphy, 1992; Gormley and Matsa, 2016; Holmstrom, 1982). Intuitively, CEO career concerns play a role in determining corporate risk. However, there are two opposing views regarding the direction of this change, whether it leads to higher or lower risk. On the one hand, career-concerned CEOs may become more ambitious, taking on higher risks to achieve performance targets. On the other hand, career-concerned CEOs may adopt a more cautious approach, taking fewer risks to prevent further failures. Consequently, the question arises as to whether career concerns influence CEO risk preferences and, in turn, corporate risk.

Addressing this question empirically is challenging due to (1) the difficulty in measuring career concerns, (2) difficulty in measuring career concerns, (3) the endogenous nature of career concerns, and (4) an obscure causal link between three

factors—missing RPE targets, career concerns, and CEO risk aversion. To address these challenges, Chapter 2 first establish a systematic examination of corporate risk across three distinct levels, including the balance sheet (profit volatility), the stock price (stock return volatility), and corporate policies (investment, cash holdings, and dividend payout). Second, I introduce ex-ante predicted dismissal probability as a proxy for CEO predictable career concerns to capture an incumbent CEOs' perception of their turnover probability. Third, I employ RDD to identify the causal impact of CEO career concerns on risk aversion. In RDD, I introduce an exogenous shock on a CEO missing the RPE target as a proxy for career concern within a narrow discontinuity range, wherein the chance for a CEO to miss (with higher career concern) or beat (with lower career concern) the RPE target is approximately random and follows a normal distribution. This RDD mitigates endogeneity (such as irrelevant confounding factors leading to CEO career concern) because whether the CEOs miss the RPE target (with higher career concern) depends on the group performance of their competitors in a similar industry—a factor beyond the CEO's control. Lastly, within the RDD framework, I introduce two-stage reduced-form regressions to establish causal links between two causal links—missing the RPE target leading to career concern in the first stage, while career concern then leads to risk aversion in the second stage. This research demonstrates a causal relationship between performance evaluation, job security, and risk aversion.

2. ESG reputational risk

Chapter 3 expands upon the scope of the Chapter 2 research by further investigating the causal impact of CEO career concerns on decreased ESG reputational risk. ESG reputational risk pertains to firm-level negative ESG news exposures, specifically ESG controversies. This risk is significant as negative controversies can harm the firm (e.g., reputation, value, revenues, share price, long-term performance, and analysts' earnings forecasts) and damage the CEO's career prospects in the labor market. Although no explicit ESG reputation incentive is specifically designed for CEOs, this thesis posits that career concern serves as an implicit incentive intrinsically embedded in a Relative Performance Evaluation (RPE). According to Jenter and Kanaan (2015), CEOs are considerably more likely to be dismissed due to negative performance shocks within an

RPE system where CEOs are compared to their peers. Moreover, RPE intensifies CEO competition in the labor market, wherein CEOs vie for top performance rankings within the same industry (Do et al., 2021; Gibbons and Murphy, 1990). This competition encompasses ESG performance in a society that demands socially respectable CEOs without tarnished reputations in ESG. Such pressure propels CEOs to avoid controversial ESG issues that may render them inferior candidates in the labor market. Specifically, when a CEO misses the RPE target, ESG reputation becomes a critical hedging tool for the CEO to mitigate career development risks. Consequently, the empirical question arises as to whether career concerns drive CEOs to reduce ESG reputational risk in a society that demands corporate social responsibility.

However, several challenges hinder empirically investigating the relationship between CEO career concerns, ESG reputational risk management, and real ESG engagement, including (1) the endogenous nature of CEO career concerns stemming from potential omitted variable bias and reverse causality issues, (2) limited data availability on firm-level ESG controversies to capture ESG reputational risk management, and (3) the unclear distinction between ESG reputational risk management and real ESG engagement undertaken by firms. To mitigate the first challenge of endogeneity, I adopt the RDD framework used in Chapter 2. Specifically, I leverage an exogenous shock to CEOs missing the RPE target as an instrument that randomly assigns higher or lower career concerns to CEOs near the threshold. This allows me to establish a causal link from the career concern instrument to ESG reputational risk management. To address the second challenge of limited ESG controversies data, I introduce an ESG controversies database from Thomson Reuters. This database provides firm-level ESG controversies data based on negative media scandals while accounting for industry materiality and company size biases. This data can better capture CEO's ESG reputational risk management strategies. Finally, to distinguish ESG reputational risk management from real ESG engagement, I run two similar sets of regression analyses on different dependent variables - ESG controversies and real ESG performance metrics. By comparing the regression results, I can delineate the differential effects of CEO career concerns on superficial ESG reputational risk management versus substantive improvements in real ESG engagement.

3. Stock price crash risk

Chapter 4 leverages unique Chinese stock market data to investigate the effect of Director Nomination Eligibility Criteria (DNEC) on stock price crash risk. Director nomination is a crucial form of institutional investor engagement in corporate governance. These institutional investors encompass hedge funds, private equity firms, asset management firms, and various other financial institutions aiming for short-term speculation in the stock market. After acquiring large market share, these institutions become increasingly active in corporate governance and occasionally intervene in the director nomination process (Black, 1997; Gillan and Starks, 2003; Hamdani and Yafeh, 2013). The growth of these activists' participation has prompted extensive research on their potential impact on the stock market. On the one hand, these institutional investors assert that they should be eligible to have their nominees in a boardroom to foster corporate growth (Bebchuk et al., 2015; Squire, 2013; Vardi, 2009).

On the other hand, research also suggests that interventions by activist hedge funds may have detrimental effects on the long-term interests of companies and their shareholders (Mizik, 2010; Pozen, 2018). Establishing higher Director Nomination Eligibility Criteria (DNEC) for shareholders could potentially hinder short-term and activist investors from intervening in corporate governance. In the age of a highly volatile stock market, the question arises as to whether higher DNEC influences stock price crash risk.

Nonetheless, several challenges obstruct answering this question, including (1) lack of U.S. data on DNEC/data availability of DNEC, (2) technical difficulty in capturing DNEC within millions of legal texts, (3) the endogenous nature of setting DNEC, and (4) an obscure mechanism between DNEC and stock price crash risk. To address these challenges, Chapter 4 first takes advantage of the unique institutional characteristics of the Chinese stock market to create a database detailing the changes in DNEC over time. Second, I manually collected data on DNEC changes in every Chinese corporate charter issued by public firms from 2009 to 2018. Third, I address the endogeneity issue by developing two novel instrumental variables—the number of law firms within a 3-kilometer radius of a listed firm and the number of executives' law-major college alumni. Fourth, I introduce the change in director background (as a proxy for the possible change in director nomination result) and financial reporting opacity (as a proxy for bad

news withholding possibilities) to link the mechanism between DNEC and stock price crash risk.

4. Outline of the thesis

This thesis explores the dynamic interplay between CEO career concerns, corporate risk behavior, and governance policies in a unique corporate environment, employing a blend of theoretical and empirical analyses across three interrelated papers.

The first paper, "CEO Career Concerns and Risk Aversion," applies RDD to illustrate the causal effect of CEO career concerns on ESG controversies, highlighting that career-concerned CEOs demonstrate a risk aversion tendency. This paper finds this effect is particularly significant for those career-concerned CEOs with less established tenures and higher proportions of deferred compensation. These CEOs exhibit significant risk aversion and influence corporate policies towards safer investments, higher cash reserves, and increased dividends. Extending the first paper's RDD methodology, the second paper, "CEO Career Concerns and ESG Controversies," illustrates the causal effect of CEO career concerns on ESG controversies, highlighting that CEOs under career-related anxieties demonstrate ESG reputational risk management, often at the expense of long-term ESG performance. The final paper, "Director Nomination Eligibility Criteria and Stock Price Crash Risk," shifts focus to governance practices, demonstrating a causal link between higher DNEC and reduced stock price crash risk, an effect amplified in Non-State-Owned Enterprises (Non-SOEs) with lower executive control, more volatile stock prices, and a higher proportion of retail investors. The thesis provides a holistic perspective on the complex relationships between executive concerns, corporate behaviors, risk management, and governance mechanisms.

In summary, these three research endeavor to identify critical factors that mitigate corporate risks. Each chapter introduces innovative data to proxy economic indicators to address various empirical challenges, employs causal inference designs to alleviate endogeneity concerns, and conducts mechanism analyses to demonstrate economic significance. Apart from academic contributions to the Empirical Finance literature, my research offers practical insights into corporate risk management for executives and

investment risk identification for investors and policymakers. The remainder of this thesis is structured as follows: Chapter 2 presents the paper titled "CEO Career Concerns and Risk Aversion"; Chapter 3 features a study, "CEO Career Concerns and ESG Controversies"; and the final empirical chapter, Chapter 4 introduces a study called "Director Nomination Eligibility Criteria and Stock Price Crash Risk". Chapter five concludes the thesis and suggests potential avenues for future research.

Chapter 2 CEO Career Concerns and Risk Aversion*

Relative Performance Evaluations (RPEs) motivate CEOs to achieve superior corporate performance. Consequently, missing the RPE target is a career concern for CEOs as it can negatively affect their career development. Career concerns can serve as an implicit incentive that motivates managers to adopt different risk preferences. This study employs a regression discontinuity design (RDD) to examine the causal impact of CEO career concerns on risk-averse corporate behavior. Utilizing the ex-ante predicted dismissal probability as a proxy for career concerns, we exploit the RPE target as an exogenous shock to CEO career concerns within the RDD framework. Our findings suggest that CEOs with heightened career concerns exhibit greater risk aversion in the subsequent year than their counterparts without such concerns. This effect is particularly pronounced for CEOs with less-established tenure and those with a higher proportion of deferred compensation. Further examination of corporate policies reveals that career-concerned CEOs undertake fewer investments, maintain higher cash reserves, and distribute more dividends, implying that career-concerned CEOs allocate a greater share of firm resources to low-risk assets to mitigate overall firm risk. Our study's findings make important theoretical contributions to agency theory and the career concerns literature by analyzing the mechanisms through which implicit incentives shape managerial risk aversion.

Keywords:
Regression Discontinuity, Relative Performance Evaluation, Risk Taking, CEO Career Concerns, Corporate Finance

JEL Classification:
G34; G38; O31; O3

* This paper, co-authored with my PhD supervisors, has been invited for presentation at the 2023 Financial Markets and Corporate Governance Conference.

1. Introduction

1.1. CEO risk preference

Relative Performance Evaluations (RPEs) motivate CEOs to achieve superior corporate performance. Nevertheless, this incentive also represents an implicit contest in which CEOs compete for the top performance rankings within their respective industries (Do et al., 2021; Gibbons and Murphy, 1990). Consequently, missing the RPE target is a career concern for CEOs as it can negatively affect their career development. Jenter and Kanaan (2015) find that CEOs are significantly more likely than their peers are to be dismissed owing to negative performance shocks within an RPE system.

The theoretical literature suggests that career concerns can serve as an implicit incentive that motivates managers to adopt different risk preferences (Fama, 1980; Holmstrom, 1982; Gibbons and Murphy, 1992; Frydman and Jenter, 2010; Gormley and Matsa, 2016). Intuitively, top executives' career concerns can be crucial determinants of firms' risk preferences. However, two conflicting perspectives emerge. Executives with high turnover rates may adopt riskier strategies and view them as opportunities for personal advancement and achievement. However, executives with significant career concerns may prefer a risk-averse approach. They aim to mitigate potential failures that could negatively affect their career trajectories. These contrasting views reflect the intricate dynamics between CEO career concerns and risk-taking behaviors in corporate decision-making. Consequently, the question arises as to whether career concerns related to missing RPE targets prompt CEOs to adopt risk-averse corporate policies.

1.2. CEO career concerns

CEO career concerns play a pivotal role in shaping corporate finance and risk management decisions. The high-stakes nature of a CEO's role amplifies these concerns. Success can yield considerable rewards, such as increased income and career opportunities, which motivate CEOs to manage their career progression cautiously. Conversely, career failure can lead to significant financial losses and impede future career prospects, thereby intensifying CEO's risk profiles and shaping their career

concerns. In a competitive labor market, CEOs must strive to maintain their standing to avoid being perceived as inferior to their peers (Cziraki and Jenter, 2020). Hence, these concerns can drive CEOs to avoid decisions that could negatively affect their career trajectory and, thus, distort the traditional principal-agent setting, such as excessive or insufficient risk-taking (Hermalin, 1993; Hirshleifer and Thakor, 1992) and biased project selection (Holmstrom and Costa, 1986; Narayanan, 1985).

In agency theory, CEOs prioritize shareholder value (Jensen and Meckling, 1976). However, when job security becomes a priority for CEOs, they may exhibit risk-averse behavior. This risk aversion can manifest as conservative corporate policies aimed at safeguarding employees' positions. Implementing such strategies might lead to higher costs, with CEOs potentially allocating corporate resources to mitigate career concerns, rather than focusing solely on shareholder wealth maximization (Masulis and Reza, 2015). The inclination toward risk-averse behavior can further complicate agency costs. Conservative corporate policies could result in suboptimal firm performance.

The interplay between career concerns and risk aversion underscores the intricate dynamics of corporate decision-making. Whether career concerns related to missing RPE targets prompt CEOs to adopt risk-averse corporate policies is of significant interest. The debate focuses chiefly on the relationship between CEO turnover and firm-specific performance measures, such as stock prices (Jensen and Warner, 1988) and acquisition activities (Jenter and Lewellen, 2015). This study aims to fill this research gap by using missing RPE targets as exogenous shocks to CEO career concerns (Cziraki and Groen-Xu, 2020). By establishing a causal link between CEO career concerns and risk aversion by examining multiple corporate policies, this study provides valuable insights into how CEO career concerns can prompt a shift toward more risk-averse corporate policies, thus, advancing our understanding of the causal impact of CEO career concerns on corporate risk-taking.

1.3. Hypothesis development

By leveraging RDD for causal analysis, we aim to construct a framework that coherently links the elements of RPE, CEO career concerns, and risk aversion. The development of this framework was guided by four key hypotheses.

Hypothesis 1: *Missing RPE targets intensifies CEO career concerns.*

The first proposes a connection between missing RPE targets and heightened CEO career concerns. Empirical evidence suggests that executive compensation contracts often incorporate RPE clauses that tie CEO compensation to firm performance relative to peers (Gibbons and Murphy, 1990). Failing to meet a specified benchmark versus peer firms can result in reduced pay if the compensation cutoff is missed. This can raise career concerns by decreasing compensation and increasing turnover risk (Jenter and Kanaan, 2015). Importantly, RPE targets may cause an exogenous shock to career concerns. CEOs often narrowly beat Absolute Performance Evaluation (APE) targets, suggesting potential manipulation. However, surpassing RPE targets is significantly more difficult because CEOs cannot control peer performance. Therefore, missing the RPE targets may lead to exogenous CEO career concerns. The combination of reduced compensation and increased turnover risk may make missing RPE targets a meaningful shock for career concerns. This is the rationale behind Hypothesis 1.

Hypothesis 2: *CEO career concerns lead to risk aversion.*

Agency theory suggests that heightened career concerns promote managerial risk aversion. Jensen and Meckling (1976) characterize executives as risk-averse agents seeking to protect their job security and reputation. Career concerns exacerbate this tendency, with greater perceived dismissal threats increasing risk aversion (Chevalier and Ellison, 1999). CEOs are theorized to be inherently risk-averse because of agency issues, and career concerns related to job tenure and reputation protection further exacerbate this tendency.

Previous research models demonstrate the specific mechanisms by which career concerns promote risk aversion (Holmstrom, 1999). Reputation concerns give CEOs incentives to avoid risky projects that may damage their reputation, revealing that poor performance hurts managerial reputation more than good performance improves it, causing overall risk aversion. The asymmetric impact of performance on reputation makes executives more cautious. Hirshleifer and Thakor (1992) develop a theoretical model that predicts that the market's assessment of a manager's talent is more sensitive

to failure than success. The market draws stronger inferences about ability from negative outcomes than from positive ones. Consequently, managers seeking to protect their reputation capital avoid innovative or risky projects where the marginal impact of potential failure is larger than the marginal benefit of success. This results in excessive conservatism rather than value-maximizing risk-taking (Holmstrom and Costa, 1986). Based on agency explanations and evidence from previous research, we hypothesize that heightened career concerns lead CEOs to make risk-averse corporate choices.

Hypothesis 3: *The effect of CEO career concerns on risk aversion is more pronounced for CEOs with shorter tenures and higher compensation.*

Agency theory provides a framework to hypothesize the heterogeneous effects of career concerns on risk aversion. According to agency theory, separating ownership and control creates conflicts between shareholders and CEOs (Jensen and Meckling, 1976). As CEOs have firm-specific human capital, they are inherently more risk averse. Career concerns related to dismissal threats increase managerial risk aversion (Amihud and Lev, 1981). However, CEO characteristics, such as tenure and compensation, may moderate the impact of career concerns. Agency theory recognizes that CEOs have diverse risk preferences and incentives that shape their reactions to career shocks. This provides a rationale for hypothesizing the differential effects of career concerns on risk aversion based on tenure and compensation.

We expect career concerns to have a greater impact on risk aversion among newer CEOs with shorter tenure. CEOs lacking an established performance record have weaker job security (Gibbons and Murphy, 1992). Missing RPE targets early in their tenure can damage perceived ability. Short-tenured CEOs also have more career years at risk if they are dismissed. Thus, the career threat of missing RPE targets is higher for CEOs with shorter tenures. To protect their reputation and career prospects, new CEOs are likely to react more cautiously to negative RPE shocks by reducing risk-taking.

We expect career concerns to have a greater impact on the risk aversion of CEOs with more deferred compensation. Deferred pay depends on long-term stability (Rajgopal and Shevlin, 2002). Career shocks may cause larger utility losses for CEOs with more deferred pay-at-stake. To protect their income and job security, CEOs with significantly

deferred compensation are likely to reduce their risk in response to negative RPE shocks. Based on agency explanations, we hypothesize differentiated effects of career concerns on risk aversion based on CEO characteristics such as tenure and deferred compensation.

Hypothesis 4: *CEO career concerns lead to risk-averse corporate policies.*

Agency theory predicts that career-concerned CEOs pursue risk-averse corporate policies that reduce risk in potentially value-creating investments. Jensen (1986) argues executives tend toward "empire building" absent incentives, causing excessive risk-taking. However, career concerns reverse this tendency, making CEOs highly risk-averse as a means to protect their jobs (Carpenter, 2000; Ross, 2004).

Career-concerned CEOs may limit capital expenditures and new projects, sacrificing growth and stability (Graham et al., 2005). Specifically, CEOs may reduce capital expenditure (CAPEX) investment, defined as capital expenditures scaled by the total assets indicating investment risk, to minimize risk. Previous research also implies that CEOs may scale back CAPEXs, reduce risk exposure, and adopt conservative strategies to prioritize stability and mitigate potential losses in particular situations, such as when facing poor organizational performance or career concerns (Capezio et al., 2011; Datta et al., 2013; Li et al., 2013; Peters and Wagner, 2014). The rationale is that decreasing capital expenditure allows CEOs to conserve cash flows and liquidity during uncertain periods. By limiting outlays for long-term investments and expansions, CEOs can stabilize a company's short-term financial position and avoid unnecessarily tying up capital when the future appears risky.

CEOs who hoard excess cash rather than funding uncertain investments buffers the firm against uncertainties and ensures stability (Almeida et al., 2004; Dittmar and Duchin, 2016). Cash holdings are defined as cash, and its equivalents are divided by sales, which indicate cash hoarding. Dittmar and Mahrt-Smith (2007) document that excess cash allows CEOs to achieve job security by avoiding the scrutiny of poor investment. Scholars have also suggested that firms with CSR activities lower equity cost by encouraging them to hoard cash or invest, instead of paying dividends (Cheung et al., 2018). These studies indicate that CEOs may accumulate excess cash reserves to

mitigate risk, ensure job security, and avoid the scrutiny of investments rather than distributing cash to shareholders or pursuing growth opportunities, especially when facing future uncertainty. The rationale is that large cash reserves provide stability and minimize downside risks.

CEO may use dividend payouts to garner shareholder support and approval, particularly when their performance is poor or threatened (Jiraporn et al., 2005). The indicator of shareholder payouts is dividend payouts, calculated as dividends divided by sales. By paying dividends, CEOs can distribute profits to shareholders, which may help mitigate dissatisfaction or unhappiness resulting from unmet RPE performance. Easterbrook (1984) presents two agency cost explanations for managers' dividend payments. One is the signaling hypothesis: managers pay dividends to signal positive prospects and manager confidence, demonstrating commitment to shareholders and alleviating concerns about performance and their career when under scrutiny. These studies provide insights showing that CEOs use dividend payouts as a lower-risk means of satisfying and obtaining support from shareholders when facing unmet performance expectations.

These behavioral factors supplement agency explanations of CEO conservatism amid career concerns. CEOs seem to prioritize near-term job security over long-run value creation amid career threats, exhibiting risk aversion, which deters growth initiatives and capital investments. This manifests in key policy dimensions, including lower capital expenditure, increased cash reserves, and heightened dividend payouts.

1.4. Research challenge

Empirically addressing whether CEO career concerns lead to risk-averse corporate policies presents several challenges. First, measuring CEOs' career concerns is difficult because they are jointly determined by the CEO's performance, subsequent evaluation outcomes, and industry-specific peer pressure. Second, CEOs' decisions regarding risk-averse corporate policies are endogenous. For instance, risk-averse CEOs may selectively join conservative firms and subsequently prefer safer corporate policies. More broadly, endogeneity issues persist when utilizing turnover probability to gauge career concerns because CEO turnover may be accompanied by unobservable changes

in corporate culture, governance, or strategy.

To address these empirical difficulties, we introduce a novel, direct, and exogenous measure of CEO career concerns: missing the RPE target, a factor beyond the CEO's control. First, failure to meet the RPE criteria is directly associated with career concerns. RPEs evaluate CEOs based on their performance relative to other CEOs in the same industry. Tournament-like RPEs intensify competition and introduce greater CEO uncertainty. Failure to meet RPE targets affects CEOs' compensation and career development because RPEs allow the market to assess CEOs' performance relative to their peers within the same industry. Underperformance in an RPE reveals a CEO's comparatively low ranking in the external labor market, constraining outside opportunities and potentially threatening their career development. CEOs recognize that these external labor markets downgrade their posterior assessments in the event of poor performance.

Second, we use turnover probabilities to capture CEO career concerns. We first use a measure of turnover to determine the likelihood of a CEOs departing after missing a target. This turnover reflects the tangible impact of missing the RPE target on CEO career development. To address issues associated with turnover probabilities, such as CEOs leaving the firm and their performance in the following year being unobservable, we also use predictive turnover as a proxy to measure career concerns. As missing the RPE target does not invariably result in turnover, predictive turnover aids in capturing an incumbent CEO's anticipated turnover probabilities after observing the turnover of other missing RPE CEOs within the same industry.

Third, failure to meet an RPE constitutes an exogenous shock to CEOs' careers. In the RPE, the relative performance of CEO peers determines whether a CEO will beat or miss a target. If career concerns do not influence CEO's risk aversion, CEOs who beat the target and those who narrowly miss it should exhibit comparable risk-averse corporate policies. If CEOs miss the target and become significantly more risk averse, it can be concluded that career concerns lead CEOs toward increased risk aversion. As manipulating RPE results is infeasible, the performance of CEOs and firms remain similar around the discontinuity point, creating an ideal setting for the regression discontinuity design (RDD). Consequently, we exploit discontinuity points between

two statuses: narrowly beating a target (no career concern) and narrowly missing a target (inducing career concerns) in a CEO's RPE. By employing an RDD, we can identify the impact of missing the RPE target on CEO risk aversion, while mitigating the confounding factors that affect CEO's risk preferences.

We conjecture that missing the RPE target induces CEOs to adopt risk-averse corporate policies to mitigate negative repercussions on their careers. Utilizing risk-taking measures in balance sheet and stock market data, we identify the significant causal impact of career concerns on risk aversion. An increase of one standard deviation in the likelihood of missing the RPE target corresponds to an approximately 7–8-point decrease in the return on assets (ROA) range, a 4–5-point decrease in the ROA standard deviation, and a 0.12%–0.18% decrease in stock return volatility. When examining the relationship between career concerns and corporate policies, missing the RPE target results in reduced investments, increased cash holdings, and larger dividend payouts. Finally, we observe that the association between missing targets and risk aversion is more pronounced among CEOs with shorter tenure and greater deferred compensation. Our findings suggest that CEOs facing escalating turnover threats due to missing RPE targets implement risk-averse corporate policies.

1.5. Research contribution

Our analysis contributes to existing literature in several ways. First, it contributes to the literature on CEO career concerns. Career concern is an implicit incentive that encourages managers to enhance their current performance and augment their future value in the labor market. While a substantial body of literature investigates the effects of explicit incentives for executives on corporate behaviors, few studies concentrate on the impacts of implicit incentives, including career concerns. Two reasons may explain this lack of extant research. First, measuring executive career concerns without managerial surveys is challenging. Second, identifying the causal effects of executive career concerns on firm performance is difficult. Most studies on career concerns utilize executive age or ex-post career outcomes as proxies, while others employ turnover, retirement, and employment contracts to capture career concerns (Cziraki and Groen-Xu, 2014).

However, these measures are imperfect indicators of career concerns. For instance, age correlates significantly with other confounding variables, such as experience. Ex-post measures struggle to differentiate between unexpected career shocks and career concerns, whereas employment contracts present self-selection issues. This study proposes a novel measure for CEO career concerns: ex-ante predicted dismissal in the subsequent year. This measure is more intuitive and accurate than existing measures.

Second, our study augments the literature on CEO risk preferences by establishing an empirical connection between job security and risk aversion. Although early theoretical literature predicted such a link (Fama, 1980; Holmstrom, 1999), empirical evidence connecting career concerns and risk aversion is scarce. The majority of research concentrates on the degree to which CEO career concerns relate to information controls (Song and Thakor, 2006), acquisition behavior (Jenter and Lewellen, 2015), loan screening (Cole et al., 2015), risk-taking (Cziraki and Groen-Xu, 2014), and investment (Li et al., 2017). In this study, we consider missing RPE scores to be an exogenous shock to CEOs and investigate whether career-concerned CEOs prefer risk-averse corporate policies.

Finally, this study contributes to literature on RPE incentives. The literature examines the relationship between RPE and earnings releases (Gong et al., 2019), corporate disclosures (Martin and Timmermans, 2021), idiosyncratic risk (Karen and Yilin, 2021), CEO's self-attribution bias (Chu et al., 2021), and corporate risk-taking (Do et al., 2021). These studies primarily concentrate on RPE's incentive nature. Building on this literature, we employ missing RPE targets as exogenous shocks to CEOs' career concerns. This method enables us to examine the influence of career concerns resulting from unmet RPE targets on adopting risk-averse corporate policies. Thus, our research provides valuable insights into the behavioral implications of RPE-driven career concerns, further enhancing our understanding of the complex interplay between executive incentives and corporate risk management.

The paper proceeds as follows. First, we review the relevant prior literature in Section 1. Next, Section 2 describes the data sample and variables constructed for our analysis. We then explain the empirical methodology in Section 3. The main results related to the hypotheses are presented in Section 4. Finally, Section 5 concludes with a summary

of key findings and implications for future research.

2. Data

2.1. Measuring career concerns

While a substantial body of literature examines the effects of explicit incentives for executives on corporate behavior (Bolton et al., 2015; Chen et al., 2006; Coles et al., 2006), few studies concentrate on the impact of implicit incentives, including career concerns. There are two primary reasons for this research gap. First, measuring executive career concerns poses a significant challenge without conducting targeted surveys of managers. Second, identifying the causal effects of executive career concerns on firm performance is complex. Most studies on career concerns use executive age (Demers et al., 2021; Gibbons and Murphy, 1992) or ex-post-career outcomes as proxies (Brickley et al., 1999). Executive turnover and retirement are closely related to career concerns. Nevertheless, these measures are imperfect indicators of career concerns, as age correlates highly with confounding variables such as experience, and ex-post measures cannot distinguish unexpected career shocks from career concerns.

In this study, we propose a novel measure for CEO career concerns: ex-ante predicted dismissal in the following year. This measure is more intuitive and accurate than existing measures in the literature. First, we integrate CEO dismissal data from (Gonçalves (2021), Jenter and Kanaan (2015), and Peters and Wagner (2014). This study postulates that at a particular time, CEOs endeavor to predict the likelihood of their dismissal by utilizing all available information at that time. We construct a set of candidate predictors with firm-level characteristics from CRSP and Compustat and executive-level characteristics from Execucomp and Institutional Shareholder Services (ISS) Incentive Lab. CEOs with higher ex-ante predicted dismissal risk exhibit greater career concerns.

For the prediction, we conducted out-of-sample logistic regressions and logistic ridge regressions on a broad array of lagged firm- and CEO-level characteristics. More

specifically, at the end of each fiscal year *T*, we train a model using all information available up to year *T* and then apply this model to predict the probability of dismissal in year *T*+1 with features up to year *T*. For logistic ridge regression, we train the model using all information available up to year *T*-1, leaving an additional year *T* as a validation set to fine-tune the penalty parameter. As the dismissal data are highly imbalanced, we employed the out-of-sample area under the precision-recall curve as the evaluation metric to adjust the hyperparameter.[1]

The pseudo code can be described as follows:

For each year *T*:

1. Divide the sample into three sets: training (year <=*T*-1), validation (year==*T*), and test (year=*T*+1).
2. For each hyperparameter value:
   a) Train the model using the training set.
   b) Make the predictions and calculate AU-PRC using the validation set.
3. Select the hyperparameter with the highest AU-PRC.
4. Retrain the model using both the training and validation sets with the selected hyperparameter.
5. Make the predictions using the test set.

Another concern is that a firm's decisions regarding executive turnover or career concerns may be endogenous, and unobservable factors may contribute to higher CEO turnover rates or greater career concerns. To address this endogeneity concern, we leveraged an RDD and used a narrowly missing RPE target as an exogenous shock to career concerns. We show that CEOs who miss the RPE target narrowly have a higher ex-ante predicted probability of dismissal and a greater ex-post probability of being dismissed within the following fiscal year.

[1] The precision-recall curve is chosen to strike a balance between precision and recall and because the dismissal data are highly imbalanced. In this case, it is better to use a precision-recall curve rather than a receiver operating characteristic curve.

2.2. RPE targets and performance

We collected RPE information from the Institutional Shareholder Services Group of Companies (ISS) Incentive Lab database in accordance with prior literature (Chu et al., 2021; Gao, 2019; Gong et al., 2019b). The ISS Incentive Lab database includes comprehensive metrics of the RPE granted in executives' compensation contracts, including grant year, evaluation period, relative benchmark, comparison method, goal target, and peer group composition for the 750 largest U.S. firms by market capitalization. The incentive lab provides peer firm information for a subset of relative performance contracts. For this subsection of contracts, relative contact has multiple peer firms on average (excluding when the S&P500 is used as a relative performance target). Subsequently, we compute the RPE target and results based on focus firms and their peer firms' performance using stock price data from the CRSP and accounting data from Compustat.

Following the sample selection procedure developed by Chu et al. (2021), we first match our dataset to the subset of firms contained in the Incentive Lab Database, known as "Gpbarel." This database provides information on the RPE contracts of the focus firm as well as the performance of peer firms. Primary summary statistics reveal that the average number of peer firms per focus firm is approximately 66, with the number of peers ranging from less than 10 to 1,392.

Second, we excluded invalid RPE samples from the dataset to avoid estimation errors. Specifically, we exclude grants with interpolated compensation[2] from the target, because there is no sharp cutoff around the target. Additionally, we exclude "one-time-hit" grants[3], which can be reached as long as the target is hit once during the vesting period. We should note that a grant may contain multiple periods, and compensation is settled at the end of each period based on whether the CEO hits the target.

[2] Managers gain part of their compensation if they miss the target; for example, if managers achieve 75% of the goal, then they will receive 75% of the compensation. We drop these grants because these contracts do not satisfy the RDD framework.

[3] In a one-time-hit grant, CEOs achieve a target as long as they hit the target during the period, but not at the end of the period. For example, a CEO must rank within the upper 25% of the stock return among peers. If the target is reached once during the vesting period, then the CEO receives the rewards. As we calculate all stock and accounting measures at the end of the period, we drop these grants.

Third, we exclude samples with accounting targets and focus solely on samples with stock price targets. This is because accounting targets are easily manipulated, whereas stock prices are nearly impossible to control. This ensures that our data fit the RDD.

Finally, we narrow the sample to relative performance grants with the performance period ending between January 2006 and December 2017. As the largest 750 firms vary by year, the database covers 2,906 unique firms between 2002 and 2018. We match relative performance grants to the CRSP to obtain stock return data and Compustat to retrieve financial statement data. Our final sample was uniquely identified by a grant and each period of the grant.

2.3. Risk aversion

For risk aversion data, we evaluate three sets of risk measures: outcomes of firm risk, such as return volatility and stock volatility; corporate financial policies, such as cash holdings; firm investment in physical assets (Capex/assets); and dividend payments.

The volatility of returns is a standard proxy for risk in the financial economics literature (Bargeron et al., 2010; Boubakri et al., 2013; Gulamhussen et al., 2012; Otchere et al., 2020) because riskier corporate operations tend to exhibit more volatile returns to capital. Consequently, we develop three proxies for the degree of risk taking in firms' operations based on the volatility of corporate earnings and stock returns: (1) industry-adjusted volatility of firm-level earnings over the sample period, (2) industry-adjusted max-min range of firm-level earnings over the sample period, and (3) volatility of stock returns. The first two measures are risk measures at the financial accounting level. We employed a two-year moving window to calculate these variables to ensure a robust assessment of risk aversion trends within the firms under study.

2.3.1. Earnings volatility

2.3.1.1. Return on assets (ROA) standard deviation

The standard deviation of ROA is a common empirical proxy for the riskiness of a firm's

operations and investment decisions. As Bargeron et al. (2010) discuss, the volatility of ROA over time provides a good summary measure of the risk in a firm's assets and operating performance. A higher variability in returns implies greater exposure to operating risks and less stable corporate policies. Thus, the standard deviation of ROA is an established metric for capturing the degree of risk in a firm's operating and investment strategies. Our primary risk measure is σ(ROA); specifically, the volatility of a firm's operating ROA. This variable directly captures the risk of a firm's investment decisions and operating performance. As the ratio of earnings to total assets, ROA is a robust risk indicator that is unlikely to be affected by changes in a firm's asset base.

To isolate the firm-specific riskiness of operations, researchers commonly adjust ROA by industry average before calculating volatility (Boubakri et al., 2013; John et al., 2008). This accounts for the industry-level factors that affect profitability each year. As Coles et al. (2006) explain, computing the standard deviation of the industry-adjusted ROA provides a measure of the riskiness of a firm's choices after removing industry-wide effects. Volatility reflects the unique risk arising from a firm's operating and investment decisions and not the common shocks that influence the industry. We adopt the volatility of the industry-adjusted ROA (ADJ_ROA) to construct our risk measures. To address industry heterogeneity, we adjust firms' annual ROAs by subtracting the industry-average ROA for each year based on 4-digit SIC codes. This industry adjustment methodology is consistent with the literature (Faccio et al., 2016; John et al., 2008).

A large body of empirical corporate finance literature uses the standard deviation of industry-adjusted ROA as a measure of managerial risk-taking behaviors (Ahmed and Duellman, 2013; Gormley and Matsa, 2016). The fluctuations in operating performance after controlling for industry effects summarize the risk exposures selected by managers through operating and investment policies. Higher ROA volatility over time indicates greater operating risk, and, thus, lower managerial risk aversion. Based on this established precedent, we adopt this risk metric to examine the impact of CEO career concerns on corporate risk-taking.

In Equations (1) and (2), N_t indexes the firms within year *t* and $ROA_{i,t}$ is the 2-year

overlapping observation period following the year in which the CEO missed the firm target. The data for the calculation are from the Compustat database. We opted for a 2-year observation period, as the evaluation typically occurs approximately two years after the initial year of the RPE assessment. That is, for each firm with available ROA for at least two years, we compute the deviation in the firm's ROA for the corresponding year, and then calculate the standard deviation of this measure for each firm.

$$ADJ\_ROA_{i,t} = ROA_{i,t} - \frac{1}{N_t}\sum_{k=1}^{N_t} ROA_{kn}$$

Equation 2-1

$$\text{Risk\_1}_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(ADJ\_ROA_{i,t} - \frac{1}{T}\sum_{t=1}^{T} ADJ\_ROA_{i,t}\right)^2} \mid T = 2$$

Equation 2-2

2.3.1.2. ROA range

In addition to using the standard deviation of ROA, prior studies have adopted the spread between the maximum and minimum ROA as an alternative metric for capturing risk-taking behavior. Examining the ROA range over a period reflects the degree to which firms allow extreme fluctuations in profitability. A wider gap between the lowest and highest ROA indicates greater tolerance for risky outcomes and volatility. Thus, along with ROA variability, ROA range provides a useful gauge of managerial risk appetite.

Specifically, researchers measure the ROA range as the difference between the maximum and minimum ROA over a multiyear period (Boubakri et al., 2013; Otchere et al., 2020). This captures the full extent of the ROA outcomes realized by the firm, showing the dispersion of returns. CEOs permitting very low minimum ROAs and very high maximum ROAs exhibit a high degree of risk-taking. Conversely, a narrower ROA range implies more consistent returns and greater risk aversion among managers. This gap reflects managers' willingness to accept volatile and extreme outcomes when

making operational choices.

$$Risk\_2_{i,t} = Max\left(Adj\_ROA_{i,t}\right) - Min\left(Adj\_ROA_{i,t}\right)$$

Equation 2-3

Building on this prior work, we incorporate the ROA range over a 2-year period, the calculation shown in the equation above, as a robustness check on our ROA standard deviation measure. Examining both metrics provides a comprehensive perspective on risk-taking, as revealed by firms' profitability outcomes. As a wider ROA range indicates that managers are more accepting of fluctuating extreme returns over time rather than pursuing stable outcomes, the ROA range offers an additional lens to the risk tolerance exhibited by operating performance. Our use of the range between the lowest and highest ROA as a complementary risk metric alongside ROA volatility further examines the dynamics of CEO risk aversion variability.

2.3.2. Stock return volatility

Stock return volatility is a popular market-based indicator of a firm's underlying risk (Low, 2009). Fluctuations in a firm's daily stock returns reflect changes in investors' risk assessments as new information about the firm is revealed. Firms that exhibit high volatility experience large stock price swings, indicating that their valuations are highly sensitive to business conditions and events. Greater return variability implies a higher exposure to operating risks. Thus, the standard deviation of stock returns serves as a forward-looking gauge of the market's perception of firm risk.

Researchers commonly compute return volatility as the standard deviation of daily stock returns over a given period (Cassell et al., 2012; Gormley and Matsa, 2016). Examining high-frequency daily returns allows us to capture the frequently shifting investor views of a firm's risks. This stock return variability summarizes market expectations of performance volatility going forward. We adopt this established method of calculating return volatility as the standard deviation of daily returns over a one-year period following a career shock. The return fluctuations over this period indicate changes in the market's assessment of a firm's underlying riskiness.

Previous studies employ the standard deviation of stock returns as a forward-looking risk indicator in accounting-based risk measures (Campbell et al., 2008). The stock market provides updated risk assessments as new information about the firm is impounded on prices each day. To comprehensively evaluate risk-taking from both the accounting and market perspectives, we examine stock return volatility and ROA-based measures. Combining accounting and market data enables a richer characterization of risk preferences revealed through managerial risk preferences. Together, these metrics provide a multifaceted risk profile that reflects both realized performance volatility and changing investor expectations. Accordingly, we employ the standard deviation of daily stock returns over the year following a missed target as a measure of firm risk according to the stock market.

$$Risk\_3_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(Return_{i,t} - \frac{1}{T}\sum_{t=1}^{T} Return_{i,t}\right)^2} \mid T = Days \;\; in \;\; a \;\; year$$

Equation 2-4

2.3.3. Capital expenditure investment

Capital expenditure investment, also known as CAPEX, is a common measure of managerial risk-taking through investment policies (Bargeron et al., 2010). CAPEX spending reflects a manager's willingness to invest in projects with uncertain payoffs. A high CAPEX indicates investment in growth opportunities despite risk rather than an emphasis on cost conservation.

Specifically, researchers often measure CAPEX investment as the ratio of capital expenditure and net asset sales to total assets (Boubakri et al., 2013; Harford et al., 2008). This captures net investment in new, potentially risky projects relative to firm size. Risk-averse managers can reduce CAPEX to scale back risky investments. By examining the changes in CAPEX/assets around career shocks to CEO, we gauge shifts in the willingness to allocate capital toward uncertain growth opportunities versus safer cost savings. Reduced investments imply greater caution and risk aversion.

Overall, a higher CAPEX indicates that managers direct more capital toward risky projects to expand operations rather than prioritizing cost cutting. To complement our earnings- and stock-based metrics, CAPEX investment provides an additional perspective on risk aversion, as revealed through managerial investment strategy choices. Examining earnings volatility, stock volatility, and investment activity allows for a multidimensional characterization of changes in CEO risk appetite following career shocks. Thus, our investment activity variable is CAPEX/TA, defined as net capital expenditure (capital expenditure minus sales of property, plants, and equipment) scaled by assets.

2.3.4. Cash holdings

The ratio of cash and cash equivalents to net sales (cash/sales) is a frequent proxy for managerial risk aversion and caution in empirical research (Mikkelson and Partch, 2003; Opler et al., 1999). This measure captures the amount of liquid assets accumulated relative to a firm's operating activities. A higher cash/sales ratio indicates that the manager holds excess cash reserves rather than investing in capital to grow the business or distribute it to shareholders (Dittmar and Mahrt-Smith, 2007). This demonstrates a focus on precaution and stability in potentially value-enhancing but risky projects.

As managers become more risk-averse, they tend to accumulate higher cash balances rather than deploy capital (Foley et al., 2007; Han and Qiu, 2007). Thus, the level of cash holdings provides insights into shifts in caution and willingness to take risks following career shocks or setbacks. Previous studies employ the cash/sales ratio as an established proxy for managerial risk appetite, with higher cash signaling greater caution and a lower propensity for risk taking (Foley et al., 2007; Han and Qiu, 2007).

The cash/sales variable captures the changes in risk aversion revealed by managers' liquidity management policies. Managers can stockpile cash as a buffer against future shocks rather than invest in value-creating projects. Holding excess cash indicates a focus on precaution rather than value-maximizing risk taking. Thus, the level of cash scaled by operating metrics such as sales serves as an established proxy for conservative risk appetite. To complement our investment and earnings/stock volatility measures, cash holdings provide an additional lens for corporate risk strategy changes following

CEO career shocks. Examining multiple policy dimensions allows for a richer characterization of how bad career outcomes potentially lead to greater managerial and risk aversion.

2.3.5. Dividend payout

Dividend policy provides insight into a firm's risk tolerance. Firms that pay high stable dividends are more risk averse (Brav et al., 2005). They forgo risky projects and investments in favor of returning profits directly to shareholders. This conservative approach satisfies shareholders through consistent payouts rather than volatile growth. Reducing dividends signals a shift toward riskier growth strategies and investments. Therefore, high dividend payouts indicate that a firm is risk averse, whereas lower payouts suggest a higher risk appetite.

The agency relationship between CEOs and shareholders can incentivize executives to pursue self-interested investments rather than optimal shareholder decisions (Jensen, 1986). A dividend policy helps address this agency cost by signaling the CEO's priorities. CEOs who focus on strong shareholder relationships prefer a stable dividend policy to avoid shareholder dislike (DeAngelo et al., 2009, 2006). Even when finances suffer, risk-averse CEOs hesitate to cut dividends because of the negative signals they send to shareholders. By contrast, CEOs with higher risk tolerance are more willing to reduce dividends to invest in risky projects. The desire for consistent dividends caters to risk-averse shareholders, who prioritize stable returns over volatile growth. Stable payouts indicate that a CEO is risk averse and committed to satisfying shareholders.

Risk-averse firms pay high dividends while maintaining substantial cash reserves. Cash provides financial flexibility and stability, whereas dividends deliver returns to shareholders. This prudent approach caters to shareholders, while maintaining liquidity in operations. The rationale is that conservative firms want to retain flexibility by holding cash as a precaution and limiting risky investment projects for stability, even though they provide shareholders with consistent returns through dividends.

Here, dividend policy aligns with other financial indicators to assess risk tolerance. Conservative risk-averse firms often pay generous dividends and hold higher cash

levels, satisfying shareholders while retaining flexibility. There are no conflicts between these policies as both cater to risk-averse preferences. The underlying rationale is to balance financial stability with shareholder returns. Dividend payouts consistently provide insights into a firm's appetite for risk versus the focus on stability for shareholders. Therefore, the dividend variable used to capture CEOs' risk-aversion strategies is dividends/sales.

2.4. Other control variables

We include a set of firm-specific characteristics as control variables, such as size, market-to-book ratio (MB), ROA, and leverage (Lev). Size is the natural logarithm of the firm's total assets. MB is the market-to-book ratio, calculated as the market value of equity divided by the book value of equity. ROA represents the return on assets computed as earnings before interest and taxes divided by total assets. Lev indicates leverage, calculated as the sum of current and long-term debt divided by total assets. We incorporate firm- and year-fixed effects into the regressions to account for unobservable firm- and time-specific factors that influence risk aversion. Table 2.1 provides the detailed definitions of these variables.

Table 2.1 Variable definition

Indicator	Variable	Explanation
RDD Indicator	Below-cutoff	Below cutoff is a dummy variable equal to one if a CEO missed a performance target in a relative performance evaluation scheme or zero otherwise.
	Distance	Distance is the difference between the actual performance of stock price metrics and the corresponding performance threshold or target from the relative performance evaluation scheme.
	Below-cutoff × Distance	The interaction term of the two variables - *Below-cutoff* and Distance.
Firm Risk Aversion	ROA Standard Deviation $_{T+1\sim T+3}$	ROA standard deviation within T+1 to T+3 periods during the subsequent 1 to 3 years after they miss the target set by Relative Performance Evaluation.
	ROA range $_{T+1\sim T+3}$	ROA range within T+1 to T+3 periods during the subsequent 1 to the 3 years after they miss the target set by Relative Performance Evaluation.
	Stock Return Volatility $_{T+1}$	Daily Stock Holding Period Return Volatility during the subsequent year after they miss the target set by Relative Performance Evaluation.
Firm Conservative Strategy	Investment $_{T+1}$	CAPEX Investment scaled by total sales in the subsequent year after CEO missed the target set by Relative Performance Evaluation.
	Cash Holding $_{T+1}$	Cash and equivalents together scaled by sales in the subsequent year after CEO misses the target set by Relative Performance Evaluation
	Dividends $_{T+1}$	Dividends payout is scaled by sales in the subsequent year period after the CEO misses the target set by Relative Performance Evaluation.
Control Variables	Size	Size is the natural logarithm of total assets in million USD.
	MB	MB is the natural logarithm of the market-to-book ratio, calculated as the market value of equity divided by the book value of equity.
	ROA	ROA is the return on asset, calculated as Operating Income Before Depreciation scaled by lag total Asset.
	CFO	Operation cash flow, calculated as Operating Activities Net Cash Flow scaled by lag total Asset
	Lev	Leverage, calculated as Long-Term Debt and Debt in Current Liabilities together scaled by total Asset

2.5. Descriptive statistics

Table 2.2. provides a comprehensive overview of the summary statistics, illustrating the key variables and their characteristics across various panels.

Panel A (Statistics on Variables) presents the descriptive statistics for control variables, CEO turnover, firm risk aversion performance, firm conservative strategy, and CEO characteristics. The statistics encompass the number of observations, mean, standard deviation, minimum, and maximum values for each variable, providing valuable insights into the distribution and variability of the data.

For CEO Turnover, Turnover T+1 exhibits a mean of 0.0650, signifying that CEO turnover occurs in a limited proportion of the sample firms. Predicted Dismissal by Logistic T+1 and Logistic and Ridge T+1 display means of 0.0429 and 0.0392, respectively, indicating that dismissal probabilities are relatively low within the sample.

Regarding Firm Risk Aversion Performance, both ROA Standard Deviation T+1T+3 and ROA range T+1T+3 reveal substantial standard deviations, demonstrating considerable variability in firms' risk aversion performance. Stock Return Volatility T+1 possesses a mean of 0.0240, suggesting that the firms in the sample generally exhibit moderate levels of stock return volatility.

Concerning Firm Conservative Strategy, Investment T+1, Dividends T+1, and Cash T+1 display means of 0.0480, 0.0570, and 0.3530, respectively, indicating that firms within the sample adhere to diverse conservative strategies characterized by varying degrees of investment, dividend payouts, and cash holdings.

Panel B (Industry Distribution) presents the distribution of industries within the sample. It enumerates the frequency, percentage, and cumulative percentage of firms across various industry sectors, such as manufacturing, finance, insurance, and real estate, among others. The data suggests a diverse industry representation within the sample.

Panel C (Year Distribution) portrays the distribution of observations across years, with

frequency, percentage, and cumulative percentage for each year. The data spans from 1998 to 2020, providing a historical perspective on the variables under investigation.

Panel D (Number of Unique Values - Data Filtering Procedure) outlines the data filtering procedure employed to arrive at the final sample. Starting with a large number of observations from Incentive Lab RPE contracts, the dataset undergoes a series of filtering steps, including merging with CRSP and Compustat, retaining only CEO contracts, and focusing on contracts with a one-year vesting period. This process results in a final sample size of 1,261 observations.

Lastly, Panel E (Number of Unique Values – Levels) highlights the number of unique values at different levels of analysis, encompassing firms, CEOs, and contracts. The final sample comprises 169 firms, 224 CEOs, and 691 contracts.

Table 2.2 Summary statistics

Panel A: Statistics on Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Controls					
Size	1,218	9.3170	1.4597	5.7826	14.8041
MB	1,204	1.1120	0.6105	-2.8215	10.7110
ROA	1,210	0.0386	0.0767	-0.5097	0.4096
CFO	1,203	0.0942	0.0687	-0.0954	0.5192
Lev	1,218	0.2657	0.1608	0.0000	1.2141
CEO Turnover					
Turnover $_{T+1}$	1,261	0.0650	0.2467	0.0000	1.0000
Pred Dismissal Logit $_{T+1}$	1,151	0.0429	0.1939	0.0000	1.0000
Pred Dismissal Logit & Ridge $_{T+1}$	1,151	0.0392	0.1689	0.0000	1.0000
Firm Risk Aversion					
ROA Standard Deviation $_{T+1\sim T+3}$	1,059	5.7820	23.6050	0.0000	358.0320
ROA Range$_{T+1\sim T+3}$	1,147	9.3430	39.5190	0.0000	620.1480
Stock Return Volatility $_{T+1}$	1,057	0.0240	0.0170	0.0020	0.1180
Firm Conservative Strategy					
Investment $_{T+1}$	1,007	0.0480	0.0580	0.0000	0.3830
Dividends $_{T+1}$	1,003	0.0570	0.0940	0.0000	1.5460
Cash $_{T+1}$	1,020	0.3530	0.6470	0.0010	4.5690
CEO Characteristics					
Tenure	858	10.3340	5.5060	1.0000	26.0000
Total current compensation	858	1108.9800	648.5980	272.1500	6500.0000
Bonus	858	93.7640	488.9640	0.0000	5000.0000
Deferred compensation	842	3364.4420	9708.2160	0.0000	86468.2660

Panel B: Industry Distribution

Types	Freq.	Percent	Cum.
Manufacturing	584	46.31	68.52
Finance, Insurance & Real Estate	275	21.81	22.20
Transport, Communications, Electric, Gas & Sanitary	121	9.60	99.60
Mining	114	9.04	77.56
Other	82	6.50	84.06
Services	65	5.15	90.01
Retail Trade	10	0.79	84.85
Construction	5	0.40	0.40
Wholesale Trade	5	0.40	100.00
Total	1261	100.00	

Continued on next page

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Panel C: Year Distribution

Year	Freq.	Percent	Cum.
1998	3	0.24	0.24
1999	3	0.24	0.48
2000	7	0.56	1.03
2001	7	0.56	1.59
2002	5	0.40	1.98
2003	3	0.24	2.22
2005	6	0.48	2.70
2006	38	3.01	5.71
2007	66	5.23	10.94
2008	100	7.93	18.87
2009	105	8.33	27.20
2010	105	8.33	35.53
2011	90	7.14	42.66
2012	94	7.45	50.12
2013	90	7.14	57.26
2014	101	8.01	65.27
2015	103	8.17	73.43
2016	86	6.82	80.25
2017	78	6.19	86.44
2018	65	5.15	91.59
2019	58	4.60	96.19
2020	48	3.81	100.00
Total	1261	100.00	

Panel D: Number of Unique Values

Procedure	Number of Obs Left
Start with Incentive Lab RPE contracts	36,278
1st: Merge with CRSP and Compustat	19,036
2nd: Only keep CEO contracts	4,182
3rd: Only keep contracts with one-year vesting period	1,261

Panel E: Number of Unique Values

Level	Number
Firm	169
CEO	224
Contracts	691

3. Empirical strategy

3.1. RDD

We employed an RDD approach, following the methodology of Chu et al. (2021), to evaluate the causal impact of career concerns on risk aversion. Casual inference requires risk aversion for treating career concerns in the RDD framework. By considering narrowly missing or exceeding the RPE target as an exogenous shock to career concerns, we examined how missing or exceeding the RPE target influences risk aversion. Our focus is on RPE targets instead of APE targets given Bennett et al.'s (2017) findings that CEOs are likely to narrowly beat APE targets, suggesting the potential manipulation of performance metrics of the APE framework. However, in an RPE, it is significantly more challenging for CEOs to precisely manipulate and surpass the target by a small margin, because they cannot control their peer firms' relative performance. Consequently, using RPE targets helps alleviate concerns about CEO manipulation of RPE outcomes near the targets. The baseline model is

$$y_i = \alpha + \beta_1 D_{ij} + \beta_2(x_{ij} - c) + \beta_3(x_{ij} - c)D_{ij} + \ controls \ + \ fixed\ effects \ + \varepsilon_i$$

Equation 2-5

where D is a dummy variable that equals one if a CEO misses the target and zero otherwise; c is the target value; and x is the running variable (or forcing variable), which is the real value of a metric. y is the measure of risk aversion.

j indexes the specific performance metric (stock price or accounting performance indicators, such as cash flow and earnings) and peer benchmark (e.g., peer group or S&P500) used for the RPE evaluation of each firm, i. This accounts for the heterogeneity in RPE designs across companies. For example, some firms may use stock price performance ranked against a peer group, whereas others may use the stock price percentile in the S&P500. Subscript j allows the model to flexibly accommodate these different performance metrics across firms.

Fixed effects include firm- and year-fixed effects. In RDD estimation, we first estimate

the optimal bandwidth based on an MSE-optimal bandwidth selector Calonico et al., (2014) and then run the regression within 75% and 125% of the optimal bandwidth. Our coefficient of interest is β_1.

The RPE comprises four distinct types of measurements characterized by a combination of relative benchmarks and comparison methods. The relative benchmark can be either a peer group or the S&P500, whereas the comparison method can be either a percentile or rank. These combinations result in various RPE characteristics, such as the RPE, which compares the stock price with a target percentile within a peer group. Almost all combinations are possible, reflecting the diversity of RPE-targeting approaches.

Metric	**Stock Price**
Relative Benchmark	Peer Group or S&P500
Compare Method	Percentile or Rank

Ideally, we would conduct the RDD for each combination separately. However, substantial heterogeneity in the combination of metrics utilized by firms results in a limited number of firms employing each specific metric. Given the focus of the RDD on instances in which targets are marginally beaten or narrowly missed, this leads to a small sample size for each metric. To address this concern, we standardized all combinations of the RPE metrics and performed a combined RDD analysis. Specifically, we standardize $(x_{ij} - c)$ as:

$$Standardized\ (x_{ij} - c) = \frac{(x_{ij} - c)}{Standard\ Deviation\ of\ (x_{ij} - c)}$$

Equation 2-6

For each j, we divided each metric by its respective standard deviation to ensure that the variance of the standardized metric was equal to one. This standardization procedure enabled us to consolidate different cutoffs into a single measure, allowing us to conduct a combined RDD based on the entire sample. We also standardized all the control variables in the regression analyses to maintain consistency. A prefix "z_" preceding a variable name indicates that the variable has been standardized by its standard deviation.

3.2. Validity of RDD

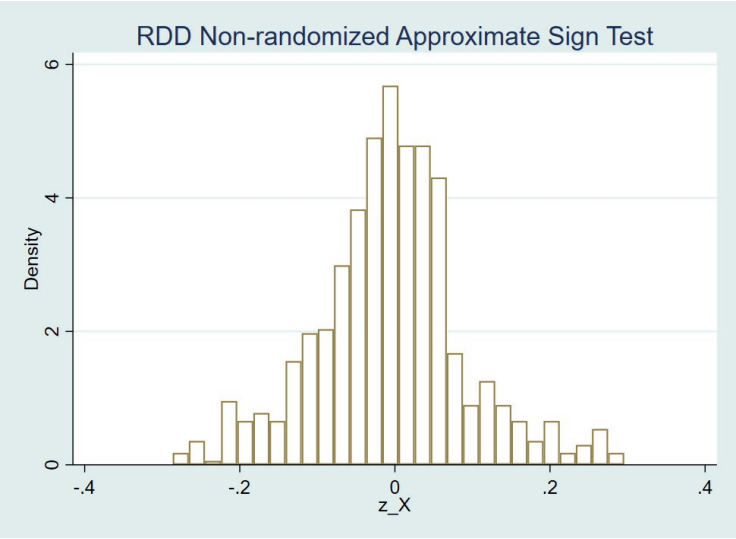
To ensure the validity of an RDD, it must meet two essential requirements: continuity in the sample distribution and the absence of preexisting differences (Imbens and Lemieux, 2008). We follow the procedures established by Chu et al. (2021) and Gao (2019) to validate that our data satisfy these conditions. First, the forcing variables around the cutoff should be "as good as randomized," meaning there should be no manipulation of the running variable around the cutoff point. The quasi-experimental assumption of the RDD would be violated if a CEO could precisely manipulate the RPE results and marginally beat the target around the right side of the cutoff. To address this concern, we examined whether the actual RPE results exhibited bunching on one side of performance goals. Second, the forcing variable should be the only variable that exhibits discontinuity at the cutoff point, while the other firm characteristic variables should display a similar pattern on both sides of the cutoff point. We compare firm characteristics around the cutoff of beating/missing the RPE target to alleviate concerns that correlated error terms of control variables may bias the RDD estimation.

3.2.1 Continuity in the distribution of relative performance

A valid RDD assumes that CEOs cannot precisely manipulate their RPE results marginally above or below the cut-off point. We employ McCrary's (2008) manipulation test to assess if there is manipulation around the RPE cut-off point. The crucial step is to test for continuity in the density function of CEOs' RPE results. If there is manipulation around the cut-off point, a bunching pattern will emerge on either side of the cut-off, leading to a significant difference between the two sides of the cut-off point. For instance, if CEOs manipulated RPE results to beat the target, there would be a greater number of observations above the cut-off point.

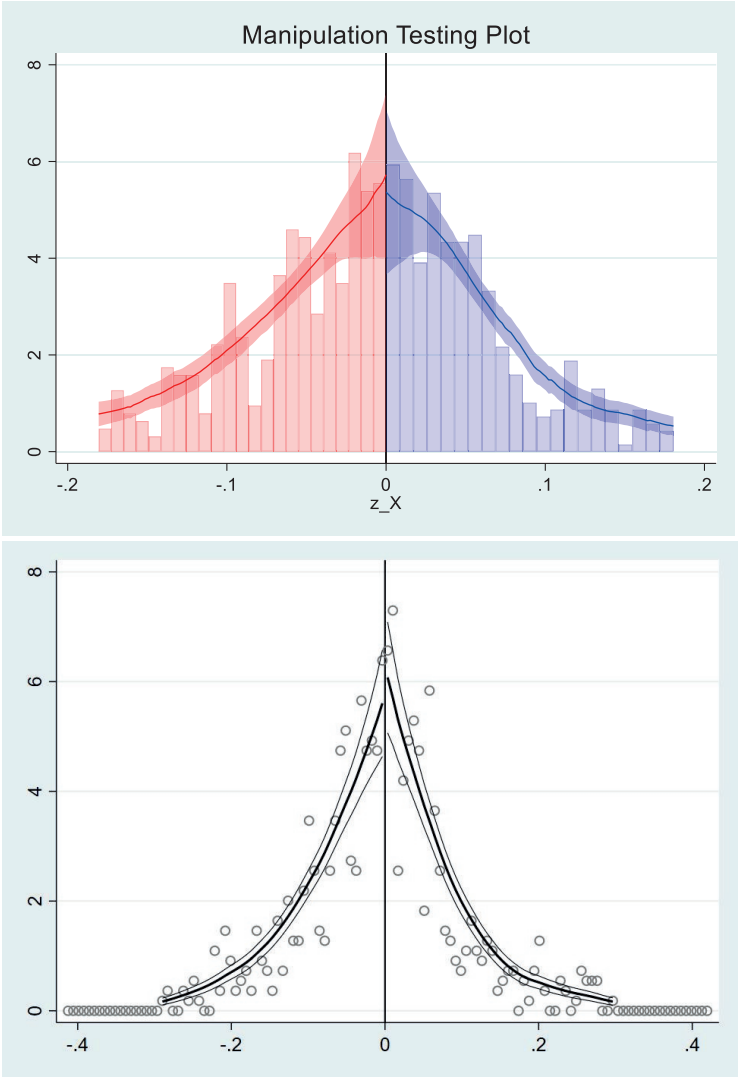
We first computed the standardized running variable $(x_{ij} - c)$ and subsequently plotted the estimated observation density around the RPE cutoff point in Figure 2.1. The histogram exhibits a standard distribution shape, indicating near-randomly distributed observations around the cutoff point.

Figure 2.1 RDD non-randomized approximate sign test



In the RDD approach, we employed data to create a histogram with a fitted line and 95% confidence interval, as visualized in Figure 2.2. The confidence intervals for both sides of the histogram are plotted, presenting an estimated range within which the true population parameters are expected to lie. Notably, these confidence intervals overlapped at the cutoff point, as shown in Figure 2.2. This implies that the means of the variables on either side of this point were not statistically different. This outcome underscores the lack of discernible manipulation or systemic bias around the cutoff, an essential observation for validating our causal inferences. The overlapping confidence intervals endorse the randomness and continuity of the underlying forcing variable around the cutoff, which is a cornerstone assumption in the RDD methodology. This absence of manipulation reaffirms the soundness of the RDD and leads us to attribute any significant discontinuity in the outcome variable at the cutoff point to the treatment effect rather than to systemic bias or manipulation. Consequently, this study provides robust empirical support for investigating causal relationships.

Figure 2.2 Manipulation testing plot



McCrary's (2008) density test, often referred to as the approximate sign statistic test, is a statistical empirical tool used to validate the RDD assumptions. This tested the null hypothesis of continuity in the density of the forcing variable at the cutoff. The test result is displayed in Table 2.3. A p-value of 0.807 is seen, which is significantly higher than the conventional thresholds (such as 0.05 or 0.01) used to reject the null hypothesis. This large p-value indicates that there is insufficient evidence to reject the null hypothesis of continuity in the distribution of the forcing variable around the cutoff. In other words, the likelihood of manipulation around the cutoff point is very low, further confirming the validity of using the RDD in this study. In summary, McCrary's (2008) density test results support the assumption that the assignment of treatment around the cutoff is random, reinforcing the credibility of the causal inferences drawn from our RDD analysis.

The three tests above confirm that the running variable *z_X* around the cutoff was nearly randomized. Thus, our data satisfy the RDD assumption of continuity.

Table 2.3 RDD test on approximate sign statistics

Running variable: z_X
Number of obs = 804 ; q = 67

Cutoff c = 0	Left of c	Right of c
Number of obs	420	384
Eff. number of obs	35	32
Eff. neighborhood	-0.006	0.006
p-value	0.807	

3.2.2 Preexisting differences

In the RDD, the preexisting differences test, also known as the placebo test, is a vital procedure to ensure that variables other than the running variable do not display any discontinuity at the cutoff point. Such discontinuities could violate the fundamental RDD assumption of locally random assignments near the cutoff, undermining the credibility of the causal inference.

This study examines the continuity in the distribution of observable covariates around the cutoff point, as detailed in Table 2.4. This test involves performing a linear regression for each covariate on the below-cutoff indicator, the running variable (*Distance*), and their interaction term (of the two (*Below-cutoff* × *Distance*), accounting for firm- and year-fixed effects within the optimal bandwidth. The control variables include financial indicators such as size, market-to-book ratio (*MB*), *ROA*, and leverage.

The results revealed that none of the regression coefficients were statistically significant, even at the 10% level. This lack of statistical significance indicates the absence of discontinuities in these covariates around the cutoff, suggesting that CEOs do not manipulate these financial ratios to meet the RPE target. This, in turn, validates the assumption that assignment to treatment around the cutoff is effectively random, thereby strengthening the validity of the RDD approach and its resulting causal inferences.

Table 2.4 Validity for preexisting difference

	(1) Size	(5) MB	(2) ROA	(3) CFO	(4) Lev
Below-cutoff	0.0098	-0.0348	-0.0016	-0.0058	0.0135
	(0.3758)	(-1.5982)	(-0.3201)	(-1.1052)	(1.6464)
Distance	0.3177	-0.2041	0.0465	-0.0729	-0.0975
	(0.7843)	(-0.7293)	(0.4874)	(-1.3978)	(-0.6568)
Below-cutoff × Distance	-0.4096	0.4288	0.0023	0.0573	0.0649
	(-1.1130)	(1.614)	(0.059)	(1.5867)	(0.988)
_cons	8.5930***	0.8994***	0.1715***	0.1956***	0.0627***
	(97.5755)	(15.6135)	(13.218)	(17.3891)	(2.6566)
N	994	983	986	979	994
r2_a	0.2199	0.235	0.0771	0.0915	0.0766
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	100%	100%	100%

This table shows differences in control variables (firm size, market-to-book ratio, ROA, and Leverage) between peer firms that beat the RPE target and those that miss the RPE target by a small margin following Imbens and Kalyanaraman (2012). Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4. Results

Our RDD regression has two stages. The first-stage RDD estimates investigate whether failing to meet RPE targets results in higher CEO career concerns, as shown in Tables 2.5, 2.6, and 2.7. The second-stage RDD constitutes the principal finding of this study, examining the causal impact of career concerns on risk aversion, as shown in the following tables.

4.1. Missing RPE target leads to higher CEO career concerns

Having validated the randomness assumption of our RDD setting, we next validated that missing the RPE target was an exogenous shock to CEO career concerns. In this section, we examine whether CEOs who narrowly miss the RPE target experience a higher turnover rate and higher ex-ante predicted dismissal probability in the subsequent year than otherwise similar CEOs who barely beat the target.

In Table 2.5, we examined the impact of missing RPE targets on CEO turnover in the subsequent year. We run an RDD regression with control variables, including both firm- and year-fixed effects. Column 1 shows that the coefficient of the missing target is significantly positive at the 5% level. The CEO turnover rate increases by 6% after a narrowly missing RPE target. Considering that CEOs may have different turnover rates in different types of firms, we add additional control variables (*firm size, market value, profitability, cash flow, and leverage*) to the regression in Column 2. As the RDD results could be sensitive to different bandwidths, we re-estimate the regression with bandwidths of 75% and 125% in Columns 3 and 4, respectively. The results exhibit a robust coefficient on the missing target indicator ($Below\text{-}cutoff_{i,t}$) is robust. Column 5 presents a similar result after including three-order polynomials for the entire sample, although the coefficient is insignificant. Hence, missing the RPE target heightens the likelihood of future turnover. In other words, CEOs who fail to meet RPE targets should be concerned about their career safety in the subsequent year, potentially owing to their underperformance in the RPE framework.

Table 2.5 Effect of CEO career concerns on CEO real turnover

	(1)	(2)	(3)	(4)
		Turnover T+1		
Below-cutoff	0.0614**	0.0644**	0.0652*	0.0583**
	(2.2111)	(2.2456)	(1.9173)	(2.1709)
Distance	0.2545	0.2747	-0.037	0.2233
	(1.0146)	(1.0154)	(-0.0916)	(1.0586)
Below-cutoff × Distance	-0.0803	-0.0846	0.488	0.0068
	(-0.2348)	(-0.2351)	(1.0211)	(0.0238)
Size		0.1304**	0.1196*	0.0823
		(2.2054)	(1.9738)	(1.2754)
MB		0.0202	-0.0085	-0.1311
		(0.3549)	(-0.1619)	(-1.5667)
ROA		-0.1025	-0.1439	-0.0374
		(-0.5030)	(-0.7394)	(-0.1828)
CFO		0.3409	0.3432	0.6068
		(0.7481)	(0.7266)	(1.3067)
Lev		0.0665	0.0872	0.1296
		(0.4427)	(0.6065)	(0.7929)
_cons	-0.0234	-1.2193**	-1.0811**	-0.9853
	(-0.4328)	(-2.4122)	(-2.0749)	(-1.6261)
N	1053	986	936	1023
r2_a	0.0314	0.0406	0.0582	0.0497
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

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This table reports the effects of CEO career concerns on CEO real turnover. The dependent variable is the career-concerned CEO's real turnover in the subsequent year after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (normal bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is β_1 *Below-cutoff*$_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that missing the RPE target leads to higher CEO real turnover, a key source of CEO career concerns.

The actual ex-post turnover is not a perfect proxy for career concerns. It consists of two components – the expected turnover and the unexpected shocks to career outcomes. We use the former turnover as our measure of career concerns. In Table 2.6, we replace CEO turnover with ex-ante Predicted Dismissal Probability and re-estimate the RDD regressions. Here, the dependent variable is estimated by out-of-sample Logistic Regressions and Logistic Regressions with L2 penalty, respectively. The L2 regularization helps reduce the variance of predictions and avoid overfitting. The coefficients of interest remain significantly positive. The economic magnitude for the effect of missing the RPE target on Predicted Dismissal Probability is slightly smaller than that for actual turnover.

Table 2.6 Effect of CEO career concerns on predicted CEO dismissal probability by logistic regression

	(1)	(2)	(3)	(4)
	Predicted CEO Dismissal Probability by Logistic Regression T+1			
Below-cutoff	0.0426**	0.0479**	0.0407**	0.0388**
	(2.1606)	(2.4315)	(2.2261)	(2.0881)
Distance	0.2064	0.1409	0.2131	-0.0106
	(1.2678)	(0.7445)	(0.7790)	(-0.0726)
Below-cutoff × Distance	-0.2286	-0.0489	-0.499	0.0445
	(-0.7839)	(-0.1696)	(-0.9703)	(0.1826)
Size		-0.015	-0.0012	-0.0139
		(-0.5431)	(-0.0335)	(-0.5113)
MB		-0.0627	-0.0425	-0.0564
		(-1.5076)	(-0.7453)	(-1.3651)
ROA		-0.4027	-0.4141	-0.4061
		(-1.2934)	(-0.8822)	(-1.2782)
CFO		0.8119***	0.6558*	0.7675***
		(2.6419)	(1.8449)	(2.6761)
Lev		0.4848***	0.2923*	0.4587***
		(3.8405)	(1.9194)	(3.5058)
_cons	-0.0289	-0.0915	-0.1946	-0.0773
	(-1.0216)	(-0.3281)	(-0.5558)	(-0.2803)
N	898	835	764	866
r2_a	0.0361	0.0963	0.0546	0.092
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

Continued on next page

This table reports the effects of CEO career concerns on Predicted CEO Dismissal Probability estimated by Logistic Regression Out-of-Sample Prediction using a large set of firm-level characteristics from Compustat and CEO-level characteristics from BoardEx. Using the ex-ante predicted dismissal probability as a proxy for career concerns, this paper exploits narrowly missing the Relative Performance Evaluation (RPE) target as an exogenous shock to CEO career concerns in the RDD setting. The dependent variable is the career-concerned CEO's real turnover in the subsequent year after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al., (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth, as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (normal bandwidth) in column (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is β_1 *Below-cutoff*$_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that missing RPE target CEOs can foresee their own turnover rate based on peers' turnover rate, another critical source of CEO career concerns.

Furthermore, we obtain similar results employing ridge regression with a penalty, as shown in Table 2.7. These results further confirm our results, signifying that missing the RPE target generates an exogenous shock to CEO career concerns. A plausible explanation is that CEOs who fail to achieve RPE targets update their expectation of dismissal risks based on their past observations of higher dismissal probability after missing the RPE target.

Overall, the above regression results align with Jenter and Kanaan's (2015) research and suggest that CEOs are terminated following unfavorable firm performance evaluation outcomes caused by factors beyond their control. Our results further support this idea by providing a two-stage RDD to address potential endogenous issues regarding missing RPE targets as a source of CEO career concerns. In the first stage, our results show that a CEO's marginally missing RDD is an unexpected negative shock of a bad performance record that leads to higher CEO career concerns. Additionally, our regression results remain robust regardless of the two measurements of CEO career concerns, including data on both actual CEO dismissals and probabilities of potential CEO terminations.

Table 2.7 Effect of CEO career concerns on predicted CEO dismissal probability by ridge regression

	(1)	(2)	(3)	(4)
	Predicted CEO Dismissal Probability by Logistic and Ridge Regression with Penalty			
	T+1			
Below-cutoff	0.0353*	0.0449**	0.0352*	0.0433**
	(1.8173)	(2.2596)	(1.8879)	(2.1377)
Distance	0.0745	0.1235	0.184	0.123
	(0.5475)	(0.8298)	(1.0883)	(1.0779)
Below-cutoff × Distance	-0.1561	-0.1781	-0.5031*	-0.1964
	(-0.7079)	(-0.7860)	(-1.6998)	(-0.9995)
Size		-0.0007	0.0074	0.0041
		(-0.0273)	(0.2728)	(0.1503)
MB		-0.0953	-0.0816	-0.0829
		(-1.4914)	(-1.2015)	(-1.2643)
ROA		-0.2676	-0.242	-0.2533
		(-0.9250)	(-0.8506)	(-0.8793)
CFO		0.7839***	0.8337***	0.7428**
		(2.6430)	(2.6273)	(2.5329)
Lev		0.0787	0.1019	0.1268
		(0.7121)	(0.9455)	(1.1070)
_cons	-0.0414	-0.0295	-0.1432	-0.0986
	(-1.1568)	(-0.0922)	(-0.4465)	(-0.3079)
N	938	873	819	904
r2_a	0.0687	0.099	0.1054	0.0946
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

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This table reports the effects of CEO career concerns on Predicted CEO Dismissal Probability estimated by Ridge Regression Out-of-Sample Prediction with L2 Penalty using a large set of firm-level characteristics from Compustat and CEO-level characteristics from BoardEx. Using the ex-ante predicted dismissal probability as a proxy for career concerns, this paper exploits narrowly missing the Relative Performance Evaluation (RPE) target as an exogenous shock to CEO career concerns in the RDD setting. The dependent variable is the career concerned CEO's real turnover in the subsequent year after they missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level, respectively. This table indicates that missing RPE target CEOs can foresee their own turnover rate based on peers' turnover rate, another critical source of CEO career concerns.

4.2. CEO career concerns lead to risk aversion

4.2.1. Earnings volatility

The ROA standard deviation serves as a risk-aversion metric at the balance sheet level, which is a proxy for volatile operating profits. A lower score indicates a more risk-averse CEO in corporate operations over the subsequent 1–3 years. We opted for a wider range of periods, extending to three years, to account for the time required for CEOs' corporate decision policies to be effective.

In the subsequent table, we examine the impact of missing RPE targets on the ROA standard deviation within T+1 to T+3 years, representing the ROA fluctuation within a three-year timeframe. Greater fluctuations signify increased risk-taking by the CEO. We conduct a similar series of RDD regressions. As illustrated in Table 2.8, our coefficients of interest (below the cutoff) are all significant at the 10% level in each specification: controlling firm characteristics (Column 2), altering the RDD bandwidth to 75% (Column 3), and 125% (Column 4) of the optimal bandwidth. The economic magnitude of the coefficient ranged from 4.6507% to 5.1526%. These findings suggest that CEOs become risk averse when making corporate financial decisions after missing their RPE targets and experiencing career concerns. One plausible explanation is that CEOs avoid risk-taking in corporate operations to prevent further adverse effects on their careers. Moreover, CEOs may use moderate operating profits to alleviate career concerns related to suboptimal RPE outcomes.

Table 2.8 Effect of CEO career concerns on risk-taking (ROA Range)

	(1)	(2)	(3)	(4)
		ROA Range T+1~T+3		
Below-cutoff	-8.3458*	-8.1261**	-7.3073*	-7.4185*
	(-1.8972)	(-1.9867)	(-1.7541)	(-1.8950)
Distance	12.2910	-2.1119	-11.7412	-4.3759
	(0.6650)	(-0.1092)	(-0.4709)	(-0.2918)
Below-cutoff × Distance	-44.8336	-37.1443	-15.4811	-23.7791
	(-1.2432)	(-1.0035)	(-0.3652)	(-0.8551)
Size		-19.3667	-20.3211	-19.3354
		(-1.2297)	(-1.3098)	(-1.2528)
MB		15.5722*	23.1088	15.3138*
		(1.6678)	(1.6308)	(1.6984)
ROA		49.4944	46.5881	47.1519
		(1.1228)	(1.0663)	(1.0872)
CFO		44.4428	23.4045	45.9621
		(0.5327)	(0.2715)	(0.5572)
Lev		57.4996	42.3370	56.2633
		(1.1285)	(0.8469)	(1.1181)
_cons	11.8316	133.8128	141.4365	132.4495
	(0.9108)	(1.0837)	(1.1345)	(1.0972)
N	998	968	922	995
r2_a	0.0795	0.1155	0.1350	0.1118
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

Continued on the next page

This table reports the effects of CEO career concerns on risk averse in balance sheet level, which is measured by ROA range within T+1 to T+3 periods. The dependent variable is the ROA range indicating the level of profitability volatility in the balance sheet during the subsequent 1 to the 3-year period after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (by using ROA range to measure profitability volatility) in the subsequent 1 to 3-year period than otherwise similar CEOs who barely beat the target.

4.2.2. Earnings range

Earnings range is another risk-aversion metric at the balance sheet level. This range reflects whether career-focused CEOs exhibit extreme operating profits. A lower score indicates a more risk-averse CEO in corporate operations over the next 1–3 years. We chose a wider range of periods, extending to three years, to account for the time required for CEOs' corporate decision policies to be effective.

In Table 2.9, we explore the impact of missing RPE targets on the ROA range within three years, representing the ROA minimum and maximum values between years T+1 and T. A higher range indicates increased CEO risk-taking. We conduct a similar series of RDD regressions. As presented in the table, our coefficients of interest (below the cutoff) are all significant at the 10% level in each specification: controlling for firm characteristics (Column 2), altering the RDD bandwidth to 75% (Column 3), and 125% (Column 4) of the optimal bandwidth. The economic magnitude ranges from 7.31% to 8.35%. These robust results further indicate that career-concerned CEOs become risk averse in corporate decisions after missing their RPE targets.

Table 2.9 Effect of CEO career concerns on risk-taking (ROA Standard Deviation)

	(1)	(2)	(3)	(4)
	ROA Standard Deviation T+1~T+3			
Below-cutoff	-5.1526*	-4.9143**	-4.1970*	-4.6507*
	(-1.9015)	(-2.0018)	(-1.6981)	(-1.9683)
Distance	2.6260	-2.4782	-7.4143	-5.3119
	(0.2832)	(-0.2396)	(-0.5418)	(-0.6470)
Below-cutoff × Distance	-19.6336	-16.9932	-0.3193	-8.3582
	(-0.9648)	(-0.7925)	(-0.0131)	(-0.5319)
Size		-8.4960	-9.6314	-8.4235
		(-0.8682)	(-0.9661)	(-0.8773)
MB		8.2597	12.3232	8.0135
		(1.6125)	(1.4607)	(1.5938)
ROA		27.9713	25.8024	26.0759
		(1.1211)	(1.0807)	(1.0743)
CFO		23.6465	12.6738	26.1858
		(0.4872)	(0.2537)	(0.5449)
Lev		42.1413	30.7950	41.1450
		(1.1975)	(0.8812)	(1.1854)
_cons	6.4598	54.6603	63.3032	54.0211
	(0.8250)	(0.6991)	(0.7783)	(0.7013)
N	923	895	848	919
r2_a	0.0765	0.1060	0.1247	0.1028
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

Continued on the next page

This table reports the effects of CEO career concerns on risk aversion at the balance sheet level, measured by ROA Standard Deviation within T+1 to T+3 periods. The dependent variable is the ROA Standard Deviation indicating the level of profitability volatility in the balance sheet during the subsequent 1 to 3-year period after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (as using ROA Standard Deviation to measure profitability volatility) in the subsequent 1 to 3-year period than otherwise similar CEOs who barely beat the target.

4.2.3. Stock return volatility

In this section, we investigate the effect of missing the RPE target on stock return volatility as a measure of CEO risk-taking behavior. We use a series of RDD regressions similar to those in the previous subsections, and Table 2.10 reports the regression results. Our coefficients of interest (below the cutoff) are significant at the 10% level in two specifications: controlling for firm characteristics (Column 2) and changing the RDD bandwidth to 75% (Column 3). However, the coefficients of interest are insignificant in the other two specifications: without controlling for firm characteristics (Column 1) and with changing the RDD bandwidth to 75% (Column 4). The economic magnitude of the coefficient ranges from 0.12% to 0.18%. These results suggest that career-concerned CEOs tend to become risk-averse in their corporate decisions related to the stock market.

In summary, the empirical findings showing reduced earnings volatility and range for CEOs missing RPE targets support Hypothesis 2 and align with prior theoretical models of career concerns and risk aversion. Specifically, our results demonstrate that career concerns provide CEOs with incentives to avoid risky projects that may damage their reputation. The evidence of lower earnings variability after missing targets suggests that CEOs are more cautious about protecting their reputations when career concerns are heightened. Furthermore, the results find that career-concerned CEOs exhibit greater risk aversion. Our findings on earnings volatility and range indicate similar dynamics, with CEOs making more conservative choices after a career shock that involves missing the RPE target. The evidence of lower stock return volatility aligns with Hypothesis 2, which states that return volatility indicates the risks perceived by investors based on the CEO's choices. The lower observed volatility suggests that the market views firms as less risky following missed targets, consistent with CEOs becoming more risk averse owing to career concerns.

Table 2.10 Effect of CEO career concerns on risk-taking (Return Volatility)

	(1)	(2)	(3)	(4)
		Stock Return Volatility T+1		
Below-cutoff	-0.0012	-0.0018*	-0.0018*	-0.0017
	(-1.3392)	(-1.7987)	(-1.8625)	(-1.5167)
Distance	-0.0017	0.0001	0.0053	0.0037
	(-0.1609)	(0.0067)	(0.4965)	(0.3216)
Below-cutoff × Distance	-0.0312	-0.0355*	-0.0479**	-0.0445*
	(-1.5495)	(-1.9248)	(-2.2285)	(-1.8995)
Size		-0.0012	-0.0039*	-0.0008
		(-0.4752)	(-1.9264)	(-0.2324)
MB		-0.0045	-0.0046	-0.0018
		(-1.2419)	(-1.2864)	(-0.4098)
ROA		-0.0054	-0.0107	0.0285
		(-0.3166)	(-0.5836)	(1.2957)
CFO		0.0169	0.0152	-0.0269
		(1.3462)	(1.1679)	(-0.9501)
Lev		0.0390***	0.0293***	0.0173
		(3.4449)	(3.2551)	(1.3545)
_cons	0.0309***	0.0386*	0.0620***	0.0170
	(9.2100)	(1.7343)	(3.5319)	(0.5874)
N	769	753	697	796
r2_a	0.6373	0.6909	0.7124	0.5959
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

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This table reports the effects of CEO career concerns on risk averse in the stock market, measured by Stock Holding Period Return (ret) Volatility in year T+1. The dependent variable is the standard deviation of daily returns indicating the level of stock price volatility in the stock market during the subsequent year after they missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (as using the standard deviation of daily returns to measure stock return volatility) in the subsequent year period than otherwise similar CEOs who barely beat the target.

4.3. Heterogeneous analysis

A previous analysis demonstrated that CEO career concerns can affect risk aversion. However, agency theory posits that CEOs may have interests that do not align with those of shareholders. To investigate how CEO characteristics influence the effect of career concerns on risk aversion, we include CEO tenure, total compensation, bonuses, and deferred compensation as interaction terms in the RDD regression, using ROA range and its standard deviation as dependent variables. The results are summarized in Table 2.11.

Columns (1) and (5) include CEO tenure as an interaction term; both coefficients are significantly positive at the 10% level. The results are robust regardless of whether the dependent variable is the ROA range or ROA standard deviation. Our findings suggest that the effect of CEO career concerns on risk aversion is more pronounced among CEOs with shorter tenure. Such CEOs may be more risk averse, as they are more concerned with establishing themselves in their role and building a successful track record. Consequently, they may prioritize stability and avoid excessive risk to protect their positions and reduce their turnover possibilities.

We then include CEO compensation, bonuses, and deferred compensation as interaction terms in different RDD regressions, using the ROA range as the dependent variable in Columns (2), (3), and (4). We run similar regressions in Columns (6), (7), and (8) by changing the dependent variable to the ROA standard deviation. The results in Columns (2) and (6) show significantly negative coefficients at the 5% level, indicating that the effect of CEO career concerns on risk aversion is more significant for CEOs with higher total compensation. This may be because higher compensation levels create higher stakes for the CEO regarding the potential consequences of poor performance caused by risk-taking projects, motivating the CEO to avoid risks and protect their own interests.

We further investigate the effect of CEO career concerns by adding CEO bonuses as an interaction term. Columns (3) and (7) show significantly negative coefficients at the 5% level, indicating that the impact of CEO career concerns on risk aversion is more

pronounced for CEOs with higher bonuses. This may be because missing target performance can significantly reduce CEO bonuses, leading career-concerned CEOs with high bonuses to prioritize stability, avoid risk to protect their next-year bonuses, and ensure that they meet future performance goals.

Finally, we obtain similar RDD regression results by changing the interaction term to deferred compensation. Columns (4) and (8) show significantly negative coefficients at the 5% level, indicating that the impact of CEO career concerns on risk aversion may be more pronounced for CEOs with greater deferred compensation. Deferred compensation provides a long-term incentive for the CEO to prioritize long-term stability, as payouts may be linked to the company's performance over an extended period. Accordingly, CEOs with higher deferred compensation may be more risk-averse, as they become more focused on building a company's long-term stability.

The empirical findings on the moderating effects of CEO tenure and compensation align with Hypothesis 3 and provide further insights into heterogeneous risk preferences based on agency theory. The evidence that career concerns have a greater impact on the risk aversion of shorter-tenured CEOs is consistent with Gibbons and Murphy's (1992) argument that newer CEOs have weaker job security and more career years at risk, making them more sensitive to career shocks. The results suggest that these less-established CEOs react more cautiously to missed targets by reducing risk, which is consistent with agency predictions.

The stronger effects on CEOs with higher total pay and bonuses also align with agency perspectives on incentives. As Rajgopal and Shevlin (2002) argue, significantly deferred compensation creates greater stakes for CEOs in maintaining firm stability. The evidence that highly paid CEOs exhibit greater risk reduction implies that career shocks have a larger impact on their incentives, leading them to adopt more conservative policies after missing targets.

Overall, the empirical results on the heterogeneous effects of career concerns based on CEO characteristics, such as tenure and compensation, further support Hypothesis 3. These findings are consistent with agency explanations that CEOs have diverse risk preferences shaped by their unique incentives and degree of career concern. By

revealing these heterogeneous effects, this analysis enriches our understanding of how agency conflict moderates CEO responses to career concerns.

Table 2.11 The interaction effect of tenue and compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ROA Range T+1~T+3				ROA Standard Deviation T+1~T+3			
Below-cutoff × Tenure	1.2585*				0.6767*			
	(1.8239)				(1.6861)			
Below-cutoff × Total Compensation		-0.0196**				-0.0112**		
		(-2.0246)				(-1.9296)		
Below-cutoff × Bonus			-0.0310**				-0.0152**	
			(-2.2763)				(-2.4234)	
Below-cutoff × Deferred Compensation				-0.0012**				-0.0006**
				(-2.4460)				(-2.0248)
N	703	703	703	688	644	644	644	629
r2_a	0.1497	0.1511	0.1484	0.1609	0.1272	0.1298	0.1298	0.1395
Interaction Control	YES	YES	YES	YES	YES	YES	YES	YES
RDD Control	YES	YES	YES	YES	YES	YES	YES	YES
Control	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
RDD Optimal Bandwidth	100%	100%	100%	100%	100%	100%	100%	100%

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This table reports the heterogeneity effects of CEO career concerns on risk aversion at the balance sheet level. The dependent variable is the ROA range, ROA Standard Deviation, which indicates the level of profitability volatility in the balance sheet during the subsequent 1 to the 3 years after they missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results using 100% bandwidth and including control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is the interaction term that includes $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who miss RPE targets in firms with more deferred compensation are more risk-averse. Total Compensation (TOTAL_CURR) is Total Current Compensation (Salary + Bonus) in units of thousands of dollars. Bonus (BONUS) is the dollar value of a bonus earned by the named executive officer during the fiscal year in units of thousands of dollars. Deferred Compensation (DEFER_BALANCE_TOT) is the aggregate balance in non-tax-qualified deferred compensation plans as of fiscal year-end in units of thousands of dollars.

4.4. CEO career concerns lead to risk-averse corporate policies

Prior research indicates that CAPEX, cash holdings, and dividend payouts are useful indicators for assessing CEO's pursuit of a risk-averse corporate strategy (Bargeron et al., 2010; Mikkelson and Partch, 2003; Opler et al., 1999; Brav et al., 2005). CAPEX reflects investments in risky projects, cash holdings represent precautionary savings, and high dividend payouts signal conservative policies that focus on shareholder payouts over risky investments. In this section, we leverage these three established empirical proxies for risk aversion to investigate whether missing RPE targets cause CEOs to shift toward more risk-averse corporate strategies owing to career concerns. Our results across the CAPEX, cash holdings, and dividend payout metrics provide robust evidence of how career concerns impact CEO strategic decision-making and corporate policies.

4.4.1. Fewer investments

The regressions in Table 2.12 examine the effect of missing the RPE target on CAPEX spending in the following year, indicating CEO's propensity to invest. We ran several RDD regressions, in which the coefficients of interest on the below-cutoff indicator were statistically significant and negative across all four model specifications. The specifications include: no controls for firm characteristics (Column 1), controls for firm characteristics (Column 2), changing the RDD bandwidth to 75% (Column 3), and changing the RDD bandwidth to 125% (column 4). The below-cutoff coefficients range from -0.0044 to -0.0070, suggesting that missing the RPE target leads to a decrease in CAPEX spending as a percentage of assets between 0.44% and 0.70% compared to CEOs who just meet the target. In economic terms, for a firm with $1 billion in assets, a 0.5% reduction in CAPEX would equal $5 million less investment spending, a meaningful amount that demonstrates decreased risk-taking by the CEO. The effect of missing the target on CAPEX is strongest when controlling for firm characteristics in the regression, indicating that the result is specifically driven by missing the target rather than inherent differences between firms.

Overall, our results show that CEOs who miss their performance targets become more risk averse and prioritize re-centering the firm's strategy and restoring short-term performance over long-term investment. The rationale is that missing a target causes CEOs to become more concerned about their job security and career prospects. Consequently, they forgo risky long-term capital investments that may hurt short-term performance metrics tied to their compensation. Their focus shifts to taking fewer risks and hitting targets in the short term to protect their jobs, rather than investing in the long term. For example, a CEO who narrowly misses a target may decide to cancel the construction of a new factory to cut costs and shore up profitability metrics. This reduction in CAPEX spending reflects increased risk aversion due to career concerns, rather than concerns about long-term value creation after missing the RPE target, which aligns with Hypothesis 4.

Table 2.12 Effect of CEO career concerns on investment

	(1)	(2)	(3)	(4)
		Investment T+1		
Below-cutoff	-0.0070**	-0.0055*	-0.0064**	-0.0044*
	(-2.1906)	(-1.8302)	(-1.9839)	(-1.6901)
Distance	-0.0564*	-0.0417*	-0.0399	-0.0127
	(-1.8254)	(-1.6896)	(-1.1803)	(-0.5947)
Below-cutoff × Distance	-0.0072	-0.0191	-0.0470	-0.0487
	(-0.1534)	(-0.4407)	(-0.7480)	(-1.3426)
Size		0.0122*	0.0120*	0.0130**
		(1.8990)	(1.8183)	(1.9821)
MB		0.0118	0.0106	0.0121
		(0.9070)	(0.8026)	(0.9715)
ROA		0.1401**	0.1478**	0.1414**
		(2.2349)	(2.0027)	(2.2604)
CFO		-0.1297	-0.1369	-0.1236
		(-1.5524)	(-1.5789)	(-1.5485)
Lev		-0.0593**	-0.0586**	-0.0582**
		(-2.3719)	(-2.1128)	(-2.3028)
_cons	-0.0029	-0.1007	-0.0932	-0.1113*
	(-0.2203)	(-1.5983)	(-1.3885)	(-1.7646)
N	810	796	752	820
r2_a	0.1776	0.2560	0.2467	0.2601
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

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This table reports the effects of CEO career concerns on investment, a corporate risk-taking strategy. The dependent variable is investment scaled by total assets indicating the level of risk conservative corporate strategy in the subsequent year after the CEO missed the target set by Relative Performance Evaluation. The less the investment is, the more conservative the corporate strategy a firm would choose. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (as using ROA range to measure profitability volatility) in the subsequent 1 to 3-year period than otherwise similar CEOs who barely beat the target.

4.4.2. More cash holdings

Table 2.13 utilizes cash holdings as a proxy for CEO risk aversion based on the rationale that risk-averse CEOs may allocate more firm assets to cash reserves rather than risky investments. Cash is a risk-free corporate asset that provides safety at the expense of potentially forgoing higher returns on riskier projects (Amihud and Lev, 1981; Dittmar and Duchin, 2016). Therefore, CEOs of firms with higher cash holdings are more risk-averse.

We run several RDD regressions using the cash holding score as the dependent variable. The coefficients of interest are all significantly negative in the four specifications: without controlling for firm characteristics (Column 1), controlling for firm characteristics (Column 2), changing the RDD bandwidth to 75% (Column 3), and changing the RDD bandwidth to 125% (Column 4). The coefficients of the below-cutoff indicator were statistically significant across all four model specifications, ranging from -5.65% to -9.78%. For example, if a firm has $1 billion in assets, a 5.65% decrease in the cash holdings to asset ratio would equal a $56.5 million reduction in cash reserves. Similarly, a 9.78% reduction would equal $97.8 million in cash. These sizable decreases in cash holdings represent the economically meaningful impact of missing the RPE target. The statistically and economically significant results suggest that missing a target reduces cash holdings substantially, reflecting increased risk aversion among CEOs concerned about their careers.

These robust results suggest that missing the RPE target causes CEOs to become more risk averse and hoard more cash reserves to avoid risk rather than pursuing uncertain positive net present value (NPV) projects. An increase in low-risk cash holdings reflects career-concerned CEOs prioritizing firm stability and playing it safely to prevent further underperformance compared to peers. These cash holdings results coincide with our previous findings that conservative investments and cash stockpiling mitigate career concerns after RPE target misses, aligning with Hypothesis 4 that CEOs prioritize near-term job security over long-term value creation due to career concerns.

Table 2.13 Effect of CEO career concerns on cash holdings

	(1)	(2)	(3)	(4)
		Cash Holding T+1		
Below-cutoff	0.0565**	0.0615*	0.0698**	0.0978*
	(2.0697)	(1.9720)	(2.1370)	(1.6644)
Distance	0.7289*	0.7210*	0.7964	1.9108
	(1.7898)	(1.8499)	(1.6039)	(1.4040)
Below-cutoff × Distance	-0.3628	-0.2745	-0.3126	-1.6436
	(-0.8058)	(-0.5973)	(-0.4643)	(-1.2850)
Size		0.0440	0.0002	0.0348
		(0.6018)	(0.0034)	(0.5817)
MB		-0.0192	-0.0102	0.0032
		(-0.1572)	(-0.0809)	(0.0301)
ROA		-0.2898	-0.5182	-0.1359
		(-0.6444)	(-1.1793)	(-0.3381)
CFO		0.2770	0.5160	-0.0017
		(0.5089)	(0.9807)	(-0.0023)
Lev		-0.3004	-0.4473	-0.4184
		(-0.8354)	(-1.1774)	(-0.8901)
_cons	0.4154**	0.0783	0.4437	0.1314
	(2.3737)	(0.0968)	(0.6073)	(0.1941)
N	761	748	697	784
r2_a	0.0273	0.0322	0.0310	0.0732
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

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This table reports the effects of CEO career concerns on cash holding, a conservative corporate strategy. The dependent variable is the next-year cash and equivalents divided by sales indicating the level of risk-conservative corporate strategy in the subsequent year after the CEO missed the target set by the Relative Performance Evaluation. This table reports the effects of CEO career concerns on risk aversion at the balance sheet level, measured by ROA range within T+1 to T+3 periods. The dependent variable is the ROA range indicating the level of profitability volatility in the balance sheet during the subsequent 1 to the 3 years after they missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (as using cash holding to measure conservative corporate strategy) in the subsequent 1 to 3 years period than otherwise similar CEOs who barely beat the target.

4.4.3. More dividends payout

Table 2.14 uses dividend payout as a proxy for risk aversion as a higher dividend payout represents a more conservative policy instead of investing in a risky, value-increasing project (Caliskan and Doukas, 2015; DeAngelo et al., 2006; Grullon et al., 2002). The results in Table 2.13 remain robust after running a similar series of RDD regressions. The coefficients of interest on the below-cutoff indicator are statistically significant and negative across specifications, ranging from -0.73% to -0.91%. For instance, for a firm with $1 billion in sales, a 0.73% increase in the dividend payout ratio would equal $7.3 million more in dividends paid out. Similarly, a 0.91% increase would translate to $9.1 million more dividends. For companies of this revenue scale, missing a the RPE target is associated with millions of dollars in additional dividend payments, rather than allocating that capital to uncertain investments.

The statistically significant results indicate that CEOs who miss RPE targets tend to favor lower-risk policies, such as boosting dividend payouts, rather than allocating capital toward uncertain value-creating investments. This aligns with agency theory, which predicts that career-concerned CEOs prefer lower-risk policies to maintain job security, even if they relate to non-ideal RPE results. Paying dividends provides a means of satisfying shareholders and mitigating their dissatisfaction when faced with unmet performance expectations. Overall, the dividend payout findings provide evidence supporting Hypothesis 4 that career concerns lead CEOs to implement risk-averse corporate policies focused on stability over risky value creation.

Overall, our findings on lower CAPEX spending, higher cash holdings, and increased dividend payouts following missed RPE targets provide further evidence that CEO career concerns promote risk aversion, which is consistent with Hypothesis 4. Reduced investment spending aligns with the argument of Bargeron et al. (2010), that a lower CAPEX indicates greater caution in allocating capital to uncertain projects rather than growth opportunities. This result suggests that career-concerned CEOs reduce risky investments, consistent with the theory. Similarly, the increase in cash holdings follows the predictions of Mikkelson and Partch (2003), that managers stockpile cash as a precaution rather than invest in risky projects when they are risk-averse. This finding

implies that CEOs focus more on stability after a career shock. Finally, the higher dividend payouts agree with (DeAngelo et al., 2009, 2006), who report that generous dividends cater to risk-averse shareholders at the expense of risky growth investments. This indicates that CEOs pursue shareholder-friendly stability over volatile investments after missing their targets.

The findings across CAPEX, cash holdings, and dividend payouts align with Hypothesis 4 and agency theory-based arguments that career concerns lead CEOs to pursue risk-averse corporate policies over potentially value-creating investments (Jensen, 1986; Carpenter, 2000; Ross, 2004). By revealing investment, cash, and dividend policy changes following RPE target misses, our analysis provides robust empirical evidence that negative career shocks exacerbate CEO risk aversion.

Table 2.14 Effect of CEO career concerns on dividends payout

	(1)	(2)	(3)	(4)
		Dividends Payout T+1		
Below-cutoff	0.0082***	0.0079**	0.0091**	0.0073**
	(2.7693)	(2.4112)	(2.4216)	(2.4007)
Distance	-0.0154	-0.0187	-0.0213	-0.0160
	(-0.7218)	(-0.7918)	(-0.6528)	(-0.7047)
Below-cutoff × Distance	0.0862**	0.0885**	0.1164*	0.0763*
	(2.1745)	(2.0816)	(1.9487)	(1.9418)
Size		0.0066	0.0065	0.0064
		(0.5322)	(0.5234)	(0.5232)
MB		0.0047	0.0047	0.0042
		(0.3242)	(0.3114)	(0.3019)
ROA		0.0533	0.0613	0.0504
		(0.6997)	(0.7466)	(0.6696)
CFO		-0.0227	-0.0320	-0.0259
		(-0.2731)	(-0.3618)	(-0.3115)
Lev		-0.0341	-0.0342	-0.0373
		(-0.4804)	(-0.4672)	(-0.5260)
_cons	0.0813***	0.0173	0.0201	0.0198
	(10.2714)	(0.1508)	(0.1740)	(0.1743)
N	850	836	813	851
r2_a	0.1357	0.1370	0.1388	0.1343
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%

Continued on the next page

This table reports the effects of CEO career concerns on dividends payout, a conservative corporate strategy. The dependent variable is the next-year dividends payout divided by sales indicating the level of risk conservative corporate strategy in the subsequent year period after the CEO missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). Column (1) does not include control variables, while Column (2) to Column (4) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 2.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that career-concerned CEOs who narrowly miss the RPE target become more risk-averse (as using dividends payout to measure conservative corporate strategy) in the subsequent 1 to 3-year period than otherwise similar CEOs who barely beat the target.

5. Conclusion

This study provides compelling empirical evidence of a robust causal relationship between CEO career concerns and corporate risk aversion. Our RDD analysis reveals that exogenous shocks to career security, in the form of narrowly missed RPE targets, significantly increase CEOs' risk aversion and appears in multiple corporate policies. These results make important theoretical contributions to agency theory and the career concerns literature by analyzing the mechanisms through which implicit incentives shape managerial risk aversion.

Specifically, our findings indicate that career shocks incentivize CEOs to prioritize personal job security over optimal risk-taking for the firm. We demonstrate that career-concerned CEOs shift their policies toward more conservative investments, greater cash holdings, and higher dividends to avoid volatility and to stabilize their positions. The results are consistent and robust across various risk metrics, including earnings volatility, stock returns, and corporate policies. Moreover, we find significant heterogeneity based on tenure and compensation structure. Newer CEOs with higher deferred pay exhibit greater jumps in risk aversion after negative RPE shocks. These findings provide further evidence that career concerns, rather than shareholder interests, are the key drivers of the observed responses.

Overall, our study deepens the scholarly understanding of the foundations of CEOs' decision-making under career concerns. We advance agency theory by revealing the primacy of career concerns in shaping CEOs' revealed risk preferences. These insights have practical implications for behavioral biases and potential remedies to align managerial incentives with optimal risk-taking.

Our innovative identification strategy utilizing an RDD for RPE shocks provides a framework for future research to further unpack the nuances of career concerns. Additional work could enrich the understanding of the heterogeneity across different CEO and firm characteristics. Our findings open exciting new empirical avenues at the intersection of executive incentives, behavioral biases, and risk management.

Chapter 3 CEO Career Concerns and ESG Controversies*

This paper uses regression discontinuity design (RDD) to identify the causal impact of CEO career concerns on ESG controversies. Using the ex ante predicted dismissal probability as a proxy for career concerns, we exploit narrowly missing the relative performance evaluation (RPE) target as an exogenous shock to CEO career concerns in the RDD setting. Our results suggest that career-concerned CEOs who narrowly miss the RPE target suffer less from negative exposures to ESG reputational risks in the subsequent year than otherwise similar CEOs who barely beat the target. This effect is more pronounced for firms with higher earnings volatilities and idiosyncratic risks. However, the decreases in ESG reputational risks induced by career concerns are not associated with improved ESG performance. In contrast, CEO career concerns can worsen overall ESG performance. Our findings imply that career-concerned CEOs prioritize ESG reputational risk management with immediate effects and neglect actual ESG engagement that requires long-term commitments.

Keywords:
Regression Discontinuity, Relative Performance Evaluation, ESG Reputational risk, CEO Career Concerns, Corporate Finance

JEL Classification:
G34; G38; O31; O3

* This paper, co-authored with my PhD supervisors, has been invited for presentation at several conferences in 2023, including the China Finance Review International & China International Risk Forum, the FMA European Conference, and the Financial Markets and Corporate Governance Conference. The scheduled presentation is at the 36th Australasian Finance and Banking Conference.

1. Introduction

1.1. ESG reputational risk management

Environmental, social, and governance (ESG) have emerged as significant business imperatives in the contemporary era (NAVEX, 2022). Corporations face tremendous pressure to circumvent ESG controversies that could negatively influence their reputations. Such controversies often include significant scandals or violations of internationally established standards, such as those stipulated by the UN Global Compact and ILO Core Conventions. To evaluate ESG controversies, Refinitiv has established an ESG scoring system that penalizes companies for controversies by giving higher scores to those with fewer and less severe issues than their industry peers. If a scandal occurs, the involved company's overall ESG score decreases. Higher scores indicate better ESG risk management practices (REFINITIV, 2021). The finance and banking industry recognizes these ESG scores as an important indicator of a firm's negative ESG media exposure and scandal risk. It is important for a firm and its CEO to manage ESG reputational risk to avoid controversies.

Avoiding such controversies is crucial for two primary reasons. First, ESG controversies can erode a company's reputation, an invaluable corporate intangible asset, leading to a decline in public trust, brand, and value and significant shifts in stakeholder perceptions. For instance, ESG incidents often draw negative media attention and incite social media criticism, undermining corporate brand value and consumer confidence (Barber et al., 2007; Dyck et al., 2019). Second, substantial empirical research suggests that ESG-related reputation crises negatively impact a variety of corporate valuation aspects, including revenues, share prices (Asante-Appiah and Lambert, 2022), firm value (Matsumura et al., 2014; Kölbel et al., 2017; Capelle-Blancard and Petit, 2019; Choi et al., 2020), long-term performance (Cohen et al., 2011; Friedman and Heinle, 2016; Krueger et al., 2020), and analysts' earnings forecasts (Derrien et al., 2022). Therefore, proactive ESG risk management minimizes ESG-related controversies and creates an opportunity for superior shareholder returns (Moody's Analytics, 2022).

While the significance of ESG reputational risk management is clear, understanding the mechanisms driving decision-makers to manage ESG risks is challenging. Most existing research delves into the consequences of ESG reputational risk, focusing less on the factors that motivate CEOs, a primary decision-making body, to engage in ESG reputational risk management. Traditional financial performance incentives designed for CEOs overlook nonfinancial performance areas such as ESG reputation risk.

Consequently, drawing on the agency-and-principal theory, the absence of suitable incentives may engender reluctance among CEOs to engage in comprehensive ESG activities due to conflicting interests and agency costs between the CEO and shareholders (Jensen and Meckling, 1976).

1.2. CEO career concerns

To illuminate the underlying motivations of CEOs in engaging with ESG risk management, we propose to bridge this domain with a critical determinant: CEO career concerns. Serving as the core of our exploration, the intersection of these two areas suggests that an understanding of CEO career concerns could be instrumental in unraveling their ESG risk management strategies.

In the vast landscape of corporate finance research, CEO career concerns have significant influence. These concerns, characterized as CEOs' appraisal of their reputations and career trajectories, are integral to corporate finance considerations. CEOs, similar to other employees, have profound investments in their career progression. However, the high-risk, high-reward nature of their position intensifies these concerns. Success in their roles can lead to substantial monetary and nonmonetary rewards such as increased income, enhanced reputation, and expanded career opportunities within the corporate ecosystem, motivating them to navigate their career advancement carefully.

Conversely, the potential consequences of career failure for a CEO are markedly severe, including substantial financial loss due to the high-income levels at risk and reputational damage that can significantly hinder future career prospects. The public visibility of their role heightens this risk. This accentuated risk profile and the

consequent reputational risk considerably shape CEO career concerns, adding a layer of complexity to their decision-making processes and extending to the management of ESG reputational risks.

In the competitive labor market, CEOs, similar to firms, have numerous alternatives (Cziraki and Jenter, 2020). Therefore, they strive to maintain a positive personal image, as any reputational damage could brand them as inferior to their competitors (Chang et al., 2010). These implicit career concerns drive CEOs to avoid actions that could tarnish their image. This drive to manage career risks informs CEOs' corporate decisions and can cause distortions in traditional principal-agent settings, such as excessive or insufficient risk-taking (Hermalin, 1993; Hirshleifer and Thakor, 1992) and biased project selection (Holmstrom and Costa, 1986; Narayanan, 1985).

Traditional agency theory suggests that CEOs must prioritize shareholder value as shareholders' agents, with ESG initiatives seen as valuable only if they enhance this value (Jensen and Meckling, 1976). However, a potential conflict arises when CEOs prioritize personal reputation, possibly leading to symbolic rather than substantive ESG activities, a phenomenon termed “greenwashing” (Basil and Weber, 2006; Delmas and Burbano, 2011; Lyon and Montgomery, 2015; Marquis et al., 2016).

We propose an extension to agency cost theory, hypothesizing that the career concerns of CEOs significantly shape the management of ESG reputational risk. CEOs with pronounced career concerns may be driven to effectively manage ESG risk to safeguard their reputations. This effective management can shield CEOs from reputational harm caused by ESG controversies (Godfrey et al., 2009). However, this strategy might incur higher costs, with CEOs possibly using corporate resources for reputation-building and career concern mitigation, not solely for shareholder wealth maximization. Similar agency cost issues, with CEOs' personal preferences influencing corporate donations and reducing firm value, have been observed in previous research (Masulis and Reza, 2015).

CEOs' potential for “greenwashing” ESG activities further complicates the agency cost. The need to mitigate reputational risk might prompt CEOs to favor the image of ESG engagement over actual implementation, possibly resulting in suboptimal ESG

performance. This aligns with symbolic management, where actions mainly project a responsible image without significant change (Cho et al., 2015). Past studies affirm this, showing that firms often "greenwash" to improve their reputations (Bénabou and Tirole, 2010; Hummel and Schlick, 2016). Hence, CEO commitment to ESG, driven by career concerns, might be more symbolic than substantial, potentially weakening ESG performance.

1.3. Relative performance evaluation

In recognizing the significance of CEO career concerns, it becomes paramount to understand how these concerns are provoked, regulated, and potentially exacerbated. One compelling mechanism that holds considerable sway in this context is relative performance evaluation (RPE).

In their pursuit of optimal corporate performance, shareholders commonly employ various strategies to stimulate CEOs' performance. A widely accepted strategy is the implementation of incentive contracts, principally segmented into two categories: absolute performance evaluation (APE) and relative performance evaluation (RPE). The core disparity between the two lies in the approach to setting performance targets. APE employs fixed and predetermined targets, affording CEOs some latitude to manipulate outcomes to meet these objectives (Bennett et al., 2017). RPE, on the other hand, establishes the performance target based on the firm's relative positioning among their industry peers.

Recently, the industry has witnessed RPE's ascendance as an essential instrument in incentivizing CEOs toward superior corporate performance. Within this competitive evaluation framework, CEO performance is assessed not only on an absolute basis but also relative to industry peers. This tournament-style setting amplifies competition and increases the uncertainty surrounding CEOs' efforts to secure recognition for their capabilities in the labor market (Gibbons and Murphy, 1990). Failure to meet the RPE standards carries risks beyond losing firm-specific compensation. It threatens their employment, reputations, and career prospects within their peer group. As a result, CEOs who underperform in this challenging RPE environment tend to experience heightened career concerns due to the associated uncertainty.

A defining attribute of RPE is its positioning of a firm's performance within a broader competitive landscape, which generates a dynamic and challenging performance target for CEOs to strive for. This relative component complicates any potential manipulation of outcomes to CEOs' advantage, ensuring that CEO performance outcomes are uniformly distributed around RPE targets.

The nonmanipulable nature of RPE provides an ideal context for implementing the RDD, a research design that leverages the discontinuity at a predetermined threshold to examine causal effects. For RDD to be valid, manipulation around the threshold should be minimal, a condition naturally met in the RPE context. The robustness of RDD under RPE is further verified through checks using different bandwidths and tests, consistently demonstrating an absence of manipulation around the threshold.

In the context of RPE, the application of RDD facilitates a deeper exploration into how RPE shapes CEOs' reactions to career concerns, specifically their management of ESG reputational risk, as measured by ESG controversy indicators. Previous analyses suggest that CEOs who narrowly miss an RPE target are likely to actively manage ESG reputational risk, presumably to counterbalance their underperformance and ease the related career concerns. Previous analyses indicate that CEOs who narrowly miss an RPE target are likely to proactively manage ESG reputational risk. This is presumably to offset their failure and alleviate the associated career concerns. This insight, enabled by the valid deployment of RDD under RPE, provides a refined understanding of how career concerns can drive CEO behavior in managing ESG reputational risks.

1.4. Hypotheses development

Leveraging RDD for causal analysis, our research endeavors to construct a framework that coherently links the elements of RPE, CEO career concerns, and ESG reputational risk management. The development of this framework is guided by four key hypotheses

Hypothesis 1: *Missing RPE targets intensifies CEO career concerns.*

The first hypothesis conjectures a connection between missing RPE targets and

heightened CEO career concerns. Empirical evidence suggests that executive compensation contracts often incorporate RPE clauses tying CEO compensation to firm performance relative to peers (Gibbons and Murphy, 1990). Missing RPE targets, defined as when a CEO fails to meet a specified benchmark versus peer firms, can result in reduced pay if it is below the compensation cutoff threshold. This can increase career concerns by decreasing compensation and increasing turnover risk (Jenter and Kanaan, 2015). Importantly, RPE targets may provide an exogenous shock to career concerns. Previous research has found that CEOs often narrowly beat APE targets, suggesting potential manipulation. However, precisely surpassing RPE targets is significantly harder since CEOs cannot control peer performance. Therefore, missing RPE targets may lead to CEO career concerns in an exogenous manner. The combination of reduced compensation and increased turnover risk may make missing RPE targets a meaningful shock to career concerns. That is the rationale behind Hypothesis 1.

Hypothesis 2*: CEO career concerns drive better management of ESG reputational risk, resulting in fewer ESG controversies.*

Drawing from the literature on agency theory, our second hypothesis argues that CEO career concerns lead to better management of ESG reputational risk, which subsequently results in fewer ESG controversies or fewer media scandals (captured by higher Refinitiv's ESG controversy scores in their database). The rationale is that CEOs with high career concerns are motivated to avoid potential damage to their personal and professional reputations (Pfarrer, Decelles, Smith, and Taylor, 2008). This entails effective management of ESG issues, as ESG controversies can adversely affect a firm's reputation and, consequently, the CEO's career prospects (Godfrey, Merrill, and Hansen, 2009).

The traditional RPE predominantly emphasizes profit-driven corporate behaviors, regarding profit maximization as the norm for corporate business. However, ESG reputation can be viewed as moral capital, an altruistic aspect reflecting a company's commitment to benefit others rather than having a purely self-centered character (Godfrey et al., 2009). Consequently, CEOs can leverage this altruistic aspect of ESG reputation as a hedging mechanism to counterbalance the risks associated with

underperformance in RPE. An enhanced ESG reputation can influence external observers to acknowledge their efforts to balance profit-making and social welfare in their decision-making process.

Moreover, CEOs' ESG reputations can indicate their capacity to positively influence social welfare and cater to the interests of a broad range of stakeholders (Simon, 1995). As a result, a favorable public perception of ESG involvement can help mitigate career concerns stemming from suboptimal RPE outcomes. To compensate for any RPE shortcomings, CEOs may partake in socially or ethically commendable ESG initiatives. The propensity to manage ESG reputational risk helps minimize the unexpected consequences arising from traditional RPE assessments. Hence, it is plausible to expect that CEOs with heightened career concerns would demonstrate greater diligence in managing ESG reputational risk than those without such concerns.

Hypothesis 3*: The impact of CEO career concerns on ESG reputational risk management is more pronounced in risk-taking firms.*

This paper develops the third hypothesis incorporating the firm's risk profile to posit a heterogeneous relationship by which the impact of CEO career concerns on ESG reputational risk management is more pronounced in risk-taking firms. Agency theory suggests that CEOs pursue riskier projects to boost short-term performance (Dechow and Sloan, 1991; Hambrick and Fukutomi, 1991). Integrating this risk-taking literature with CEO career concerns yields implications for ESG reputational risk management.

CEOs of high-risk firms, defined as those with greater financial volatility (captured by standard deviation, range of return on assets and return on equity) and stock price risk (idiosyncratic risk, systematic risk, total risk), face more exposure to ESG controversies that damage reputation (John et al., 2008). Financial volatility measures such as standard deviation and range of return on assets and equity indicate instability in profitability. Firms with unstable and fluctuating returns face risks of adverse shocks triggering ESG incidents. Stock price risk metrics capture market- and firm-specific volatility. Higher stock price volatility signals susceptibility to ESG events, causing reputational harm via sharp stock declines.

As ESG incidents hurt CEO reputation and job mobility (Krüger, 2015), career-concerned CEOs have higher incentives to mitigate ESG reputational risks, especially in high-risk firms. This hypothesis is established based on how career concerns interact with firm risk profiles to shape ESG reputational risk management incentives.

Hypothesis 4*: CEO career concerns are associated with lower ESG performance, suggesting the prioritization of ESG reputational risk management over genuine ESG engagement.*

Agency theory suggests that agents such as CEOs aim to maximize their own utility rather than principals' interests (Jensen and Meckling, 1976). Previous studies have examined CEO career concerns arising from the desire to bolster personal reputations and future job prospects (Gibbons and Murphy, 1992; Holmstrom, 1999). These career incentives lead CEOs to make decisions that improve observable signals of ability, even if they are not value-maximizing for shareholders (Bénabou and Tirole, 2010; Cho et al., 2015; Stein, 1989).

Applying this agency view to ESG strategy implies that CEOs may undertake symbolic ESG efforts (such as reducing ESG controversies or scandals in media captured by Refinitiv's ESG controversy score) for résumé-building while avoiding meaningful initiatives (such as real ESG engagement as captured by Refinitiv's ESG Indicators) that require substantial effort and resources. For example, they may reduce media controversies through selective disclosures while avoiding meaningful ESG engagements requiring substantial resources. Research shows that reputational risks make CEOs more likely to pursue impression management, such as greenwashing (Marquis et al., 2016). The prevalence of greenwashing suggests that firms exaggerate ESG achievements and conceal negative impacts (Delmas and Burbano, 2011; Lyon and Montgomery, 2015)

Taken together, this evidence indicates that CEO career concerns tend to emphasize superficial ESG signaling over fundamental change. While CEOs are incentivized to maintain outward ESG commitment due to reputation considerations, the underlying motivation is self-promotion rather than improving ESG performance. Consequently,

CEO career concerns may undermine firms' ESG efforts, leading to lower real sustainability outcomes. We therefore hypothesize that greater CEO career concerns are associated with reduced ESG performance.

1.5. Research contribution

Building on our research hypotheses, we highlight our study's potential contributions to financial economics. We aim to augment the understanding of the complex interplay among RPE, CEO career concerns, and ESG reputational risk management, ultimately offering valuable insights into firm ESG performance. By integrating concepts from agency theory, executive compensation, and corporate risk-taking, our research enriches the corporate finance literature and opens promising avenues for future empirical work. Specifically, we offer a fresh perspective on performance-based contracts and ESG reputational risk management, framing them within the context of RPE and CEO career concerns.

The first significant contribution of this paper is the validation of RPE as a more rigorous and nonmanipulable framework than APE. This aspect provides a greater impetus for the application of RDD to study the causal relationship between CEO career concerns and ESG reputational risk. The derived insights considerably augment the literature on executive compensation, CEO behavior, and corporate ESG risk management. Furthermore, it highlights the imperative for additional research into CEOs' navigation of complex incentive structures and career risks while upholding their accountability for sustainable corporate performance.

Second, this paper enhances the body of knowledge related to performance-based contracts. An emergent corpus of literature delves into the impact of performance-based compensation on managerial behavior (Bennett et al., 2017; Bettis et al., 2010, 2018; Murphy, 2000). Our research aligns closely with the findings of Cao et al. (2019), who suggest that managers failing to achieve a relative performance goal are more likely to engage in opportunistic insider trading as compensation for their loss. A parallel can also be drawn with the recent study by Chu et al., (2021). Complementing these works, our research demonstrates that CEOs failing to meet an RPE target tend to effectively

manage ESG reputational risk, utilizing it as a strategic tool to offset their underperformance in RPE.

Finally, this study adds to the literature on ESG reputational risk management. While numerous studies investigate the relationship between ESG and corporate financial decisions, our research takes a step further by directly identifying the strategies employed by CEOs in managing ESG reputational risk after failing to meet a target. This approach marks a departure from previous literature by applying RDD and using a direct measure of ESG reputational risk management. Consequently, we are able to scrutinize the causal relationship between CEO career concerns and their management of ESG reputational risk in greater depth. By bridging these key areas of financial economics, this study provides a robust and comprehensive understanding of the role of RPE in influencing CEO behavior and career concerns.

The remainder of the paper is organized as follows. Section 1 reviews the literature. Section 2 presents the data and variables used in the study. Section 3 outlines the empirical methodology. Section 4 reports the primary empirical results concerning the hypotheses, and Section 5 offers concluding remarks.

2. Data

We gather data on career concerns, RPE, and ESG reputational risk from multiple databases. We adopt Chapter 2's methodology to construct career concerns and RPE data.

2.1. Measuring career concerns

Career concern serves as an implicit incentive that encourages managers to enhance current performance and augment their future value in the labor market (Fama, 1980; Holmstrom, 1999). While a substantial body of literature examines the effects of explicit incentives for executives on corporate behavior (Bolton et al., 2015; Chen et al., 2006; Coles et al., 2006), limited research focuses on the impact of implicit incentives, including career concerns. Two primary reasons contribute to this gap in

research. First, measuring executive career concerns poses a significant challenge without conducting targeted surveys on managers. Second, identifying the causal effects of executive career concerns on firm performance proves to be a complex task. Most studies on career concerns utilize executive age (Demers et al., 2021; Gibbons and Murphy, 1992) or ex-post career outcomes as proxies (Brickley et al., 1999). Moreover, executive turnover and retirement are closely related to career concerns. Nevertheless, these measures are imperfect indicators for career concerns, as age correlates highly with confounding variables such as experience, while ex post measures cannot distinguish unexpected career shocks from career concerns.

This paper adopts Chapter 2's method and proposes a novel measure for CEO career concerns: the ex ante predicted dismissal in the following year. This measure is more intuitive and accurate than existing measures in the literature. We first integrate CEO dismissal data from (Gonçalves, (2021), Jenter and Kanaan (2015), and Peters and Wagner (2014)). Then, this paper conjectures that at a particular point in time, the CEO endeavors to predict the likelihood of their dismissal in the future by utilizing all the available information at that time. We construct a set of candidate predictors with firm-level characteristics from CRSP and Compustat and executive-level characteristics from Execucomp and ISS Incentive Lab. CEOs with higher ex ante predicted dismissal risks exhibit greater career concerns.

For prediction, we also follow Chapter 2's method to conduct out-of-sample logistic regressions and logistic ridge regressions on a broad array of lagged firm- and CEO-level characteristics. More specifically, at the end of each fiscal year T, we train a model using all information available up to year T and then apply this model to predict the probability of dismissal in year T+1 with features up to year T. For logistic ridge regression, we train the model using all information available up to year T-1, leaving an additional year T as a validation set to fine-tune the penalty parameter. As the dismissal data are highly imbalanced, we employed the out-of-sample area under the precision-recall curve as the evaluation metric to adjust the hyperparameter.[1]

[1] The precision-recall curve is chosen to strike a balance between precision and recall and because the dismissal data are highly imbalanced. In this case, it is better to use a precision-recall curve rather than a receiver operating characteristic curve.

The pseudo code can be described as follows:

For each year *T*:

6. Divide the sample into three sets: training (year <=*T*-1), validation (year==*T*), and test (year=*T*+1).
7. For each hyperparameter value:
   a) Train the model using the training set.
   b) Make the predictions and calculate AU-PRC using the validation set.
8. Select the hyperparameter with the highest AU-PRC.
9. Retrain the model using both the training and validation sets with the selected hyperparameter.
10. Make the predictions using the test set.

Another concern is that a firm's decisions regarding executive turnover or career concerns may be endogenous, and unobservable factors may contribute to higher CEO turnover rates or greater career concerns. To address this endogeneity concern, we leveraged an RDD and used a narrowly missing RPE target as an exogenous shock to career concerns. We show that CEOs who miss the RPE target narrowly have a higher ex-ante predicted probability of dismissal and a greater ex-post probability of being dismissed within the following fiscal year.

2.2. RPE targets and performances

This paper adopts Chapter 2's method to collect RPE information from the Institutional Shareholder Services Group of Companies (ISS) Incentive Lab database, in accordance with previous literature (Chu et al., 2021; Gao, 2019; Gong et al., 2019). The ISS Incentive Lab database includes comprehensive metrics RPE granted in executives' compensation contracts, including grant year, evaluation period, relative benchmark, compare method, goal target, and peer group composition for the 750 largest U.S. firms by market capitalization. The Incentive Lab provides peer-firm information for a subset of the relative performance contracts. For this subsect of contracts, a relative contact has multiple peer firms on average (not including when the S&P 500 is used as a relative performance target). Subsequently, we compute the RPE target and results based on the focus firms and their peer firms' performance based on stock price data from CRSP and

accounting data from Compustat.

Following the sample selection procedure developed by Chu et al. (2021), we commence our analysis by matching our dataset to the subset of firms contained in the Incentive Lab Database, known as "Gpbarel". This database provides information on the RPE contracts of the focus firm, as well as the performance of peer firms. The primary summary statistics reveal that the average number of peer firms per focus firm is approximately 66, with the number of peers ranging from less than 10 to 1,392.

Second, we excluded invalid RPE samples from the dataset to avoid estimation errors. Specifically, we exclude grants with interpolated compensation[2] from the target, because there is no sharp cutoff around the target. Additionally, we exclude "one-time-hit" grants[3], which can be reached as long as the target is hit once during the vesting period. We should note that a grant may contain multiple periods, and compensation is settled at the end of each period based on whether the CEO hits the target.

Third, we exclude the sample with an accounting target and focus solely on the sample with a stock price target because accounting targets are easily subject to manipulation, while stock prices are nearly impossible to control. This fact ensures that our data are fitted for RDD design.

Finally, we narrowed the sample down to relative performance grants with a performance period ending between January 2006 and December 2017. As the 750 largest firms vary by year, the database covers 2906 unique firms between 2002 and 2018. We match relative performance grants to CRSP to obtain stock return data and Compustat to retrieve financial statement data. Our final sample is uniquely identified by grant and each different period of the grant.

[2] Managers gain part of their compensation if they miss the target; for example, if managers achieve 75% of the goal, then they will receive 75% of the compensation. We drop these grants because these contracts do not satisfy the RDD framework.

[3] In a one-time-hit grant, CEOs achieve a target as long as they hit the target during the period, but not at the end of the period. For example, a CEO must rank within the upper 25% of the stock return among peers. If the target is reached once during the vesting period, then the CEO receives the rewards. As we calculate all stock and accounting measures at the end of the period, we drop these grants.

2.3. ESG Reputational risk

We employ Refinitiv's ESG controversy score to assess ESG reputational risk exposure. This metric tallies publicly disclosed controversies across 23 environmental, social, and governance areas. It applies severity weights based on market capitalization, penalizing large firms less for equivalent controversies to account for media bias favoring large corporations. The ESG controversy score is calculated based on these 23 ESG controversy topics. If a scandal occurs during the year, the involved company is penalized, which decreases their overall ESG controversy score, and the impact may persist into the next year if there are ongoing related developments such as litigation or fines. All new media coverage is captured as the controversy progresses. More frequent and more egregious controversies directly decrease companies' scores, benchmarked by industry distribution between 0-100% (REFINITIV, 2021). According to Refinitiv's scoring system, higher scores indicate fewer and less severe controversies relative to industry peers, signifying better ESG reputational risk management practices.

Accordingly, the ESG controversies score provides a direct gauge of firm-level proficiency in mitigating ESG reputational risks and material controversies, constituting an informative ESG reputational risk management metric. Our dataset reflects improved ESG reputational risk management in higher ESG controversy scores. Apart from ESG controversy scores, we also include Refinitiv's Comprehensive ESG pillar scores to evaluate firm-level real and substantive engagement in ESG activities.

The Refinitiv ESG controversy data are ideal for our empirical study of its detailed, comprehensive, and reliable characteristics. First, the Refinitiv database provides in-depth information about ESG reputational risk. Second, the Refinitiv database is one of the world's most comprehensive ESG reputational risk datasets. Covering over 70% of the global market cap and with a history dating back to 2002, the Refinitiv ESG scores enable us to match the majority of the ISS Incentive Lab database to ESG data. Third, the Refinitiv database has a highly reliable data structure. As one of the world's largest financial market providers, Refinitiv extracts ESG information from publicly available and auditable data sources, meticulously designed to transparently and objectively assess companies' relative ESG reputational risks and capacities.

2.4. Other control variables

Consistent with previous studies on corporate social responsibility (e.g., Cao et al., 2019), we include a set of firm-specific characteristics as control variables, including *size, MB, ROA, and lev*. *Size* is the natural logarithm of a firm's total assets. We define *MB* as the market-to-book ratio, calculated as the market value of equity divided by the book value of equity. *ROA* is the return on assets, calculated as earnings before interest and tax divided by total assets. We define *lev* as leverage, calculated as the sum of current debt and long-term debt divided by total assets. We include firm- and year-fixed effects in the regressions to control for unobservable firm-specific and time-specific factors that affect corporate ESG reputational risk. We summarize the detailed definition of the variable in Table 3.1.

Table 3.1 Variable definition

Indicator	Variable	Explanation
RDD Indicator	Below-cutoff	Below cutoff is a dummy variable equal to one if a CEO missed a performance target in a relative performance evaluation scheme or zero otherwise.
	Distance	Distance is the difference between the actual performance of stock price metrics and the corresponding performance threshold or target from the relative performance evaluation scheme.
	Below-cutoff × Distance	The interaction term of the two variables - *Below-cutoff* and Distance.
ESG Measurement	△ESG Combined	ESG Combined = Environmental pillar categories (0.34) + Social pillar categories (0.42) + Corporate governance categories (0.24). This score is index value from 0-100.
	△ESG Controversy	ESG controversies score is calculated based on 23 ESG controversy topics, with recent controversies reflected in the latest complete period. The default value of all controversy measures is 0. All recent controversies are counted in the latest closed fiscal year, and no controversy is double-counted• Controversies are benchmarked on industry group• Companies with no controversies will get a score of 100. Controversy score calculation addresses the market cap bias from which large-cap companies suffer, as they attract more media attention than smaller-cap companies. Severity weights are applied to address market-cap bias and are applicable for the calculation of current and historical periods. This score is index value from 0-100
	△Social	Social pillar categories = workforce (0.10) + human rights (0.15) + community (0.08) + product responsibility (0.09) = 0.42. This score is index value from 0-100
	△Environment	Environmental pillar categories = resource use (0.08) + emissions (0.10) + innovation (0.16) = 0.34. This score is index value from 0-100
	△Governance	Corporate governance categories = management (0.16) + shareholders (0.05) + CSR strategy (0.03) = 0.24. This score is index value from 0-100
Control Variables	Size	Size is the natural logarithm of total assets in million USD.
	MB	MB is the natural logarithm of the market-to-book ratio, calculated as the market value of equity divided by the book value of equity.
	ROA	ROA is the return on asset, calculated as Operating Income Before Depreciation scaled by lag total Asset.
	CFO	Operation cash flow, calculated as Operating Activities Net Cash Flow scaled by lag total Asset
	Lev	Leverage, calculated as Long-Term Debt and Debt in Current Liabilities together scaled by total Asset

2.5. Descriptive statistics

Table 3.2 presented above, provide a comprehensive overview of the dataset used in this study. In the following paragraphs, a brief statistical analysis of the key variables, industry distribution, and year distribution will be provided more formally, logically, and academically.

Panel A reports the summary statistics for the control variables, CEO turnover, ESG metrics, and firm risk-taking measures. The size variable has a mean of 9.3170 with a standard deviation of 1.4597, indicating moderate variability among firms. The ESG controversies score exhibits a slight negative mean change (-0.0054) with a considerable standard deviation (0.2601), suggesting notable differences in ESG controversies across firms.

Panel B reveals the distribution of the sample across various industries. Manufacturing represents the largest sector, accounting for 46.31% of the sample, followed by finance, insurance, and real estate (21.81%). Construction and wholesale trade are the least represented industries, both at 0.40%.

Panel C presents the sample distribution over time, ranging from 1998 to 2020. The data demonstrate an increasing trend in the number of observations over time, with the highest number of observations in 2009 and 2010 (both at 8.33% of the sample). The lowest frequency is observed in the early years of the sample, specifically from 1998 to 2003, with percentages ranging from 0.24% to 0.56%.

Panel D outlines the data preprocessing procedures and the number of observations left after each step. The final sample consists of 1,261 observations, reduced from an initial 36,278 RPE contracts in the Incentive Lab dataset.

Finally, Panel E displays the number of unique values for firms, CEOs, and contracts, with 169 firms, 224 CEOs, and 691 contracts, respectively. This information highlights the diversity of the sample in terms of firms and their executives, providing a solid foundation for the study's empirical analysis.

In conclusion, the presented tables and statistical analysis offer an in-depth understanding of the dataset's composition, distribution across industries and time, and the characteristics of key variables. This comprehensive overview sets the stage for a rigorous examination of the research questions posed in the study.

Table 3.2 Summary Statistics

Panel A: Statistics on Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Controls					
Size	1,218	9.3170	1.4597	5.7826	14.8041
MB	1,204	1.1120	0.6105	-2.8215	10.7110
ROA	1,210	0.0386	0.0767	-0.5097	0.4096
CFO	1,203	0.0942	0.0687	-0.0954	0.5192
Lev	1,218	0.2657	0.1608	0.0000	1.2141
CEO Turnover					
Turnover $_{T+1}$	1,261	0.0650	0.2467	0.0000	1.0000
Pred Dismissal Logit $_{T+1}$	1,151	0.0429	0.1939	0.0000	1.0000
Pred Dismissal Logit & Ridge $_{T+1}$	1,151	0.0392	0.1689	0.0000	1.0000
ESG Measurement					
△ESG Controversies Score $_{T+1}$	973	-0.0054	0.2601	-0.9583	0.9583
△ESG $_{T+1}$	973	0.0269	0.0763	-0.1480	0.3847
△Environment $_{T+1}$	973	0.0396	0.1230	-0.3666	0.6284
△Social $_{T+1}$	973	0.0202	0.0840	-0.2936	0.4037
△Governance $_{T+1}$	973	0.0139	0.1241	-0.4123	0.4639
Firm Risk-taking					
ROA Standard Deviation	1,048	1.5645	11.7585	0.0001	350.3173
ROA Range	1,132	2.5651	19.6295	0.0000	606.7772
ROE Standard Deviation	1,146	2.7307	30.0283	0.0020	715.4479
ROE Range	1,231	4.4949	50.3131	0.0000	1240.3490
Idiosyncratic Risk	1,006	-0.7081	0.7764	-2.3060	0.5342
System Risk	1,006	-1.6036	0.5524	-3.7129	-0.1154
Total Risk	1,006	-1.1255	0.4942	-2.1851	0.6276

Panel B: Industry Distribution

Types	Freq.	Percent	Cum.
Manufacturing	584	46.31	68.52
Finance, Insurance & Real Estate	275	21.81	22.20
Transport, Communications, Electric, Gas & Sanitary	121	9.60	99.60
Mining	114	9.04	77.56
Other	82	6.50	84.06
Services	65	5.15	90.01
Retail Trade	10	0.79	84.85
Construction	5	0.40	0.40
Wholesale Trade	5	0.40	100.00
Total	1261	100.00	

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Panel C: Year Distribution

Year	Freq.	Percent	Cum.
1998	3	0.24	0.24
1999	3	0.24	0.48
2000	7	0.56	1.03
2001	7	0.56	1.59
2002	5	0.40	1.98
2003	3	0.24	2.22
2005	6	0.48	2.70
2006	38	3.01	5.71
2007	66	5.23	10.94
2008	100	7.93	18.87
2009	105	8.33	27.20
2010	105	8.33	35.53
2011	90	7.14	42.66
2012	94	7.45	50.12
2013	90	7.14	57.26
2014	101	8.01	65.27
2015	103	8.17	73.43
2016	86	6.82	80.25
2017	78	6.19	86.44
2018	65	5.15	91.59
2019	58	4.60	96.19
2020	48	3.81	100.00
Total	1261	100.00	

Panel D: Number of Unique Values

Procedure	Number of Obs Left
Start with Incentive Lab RPE contracts	36,278
1st: Merge with CRSP and Compustat	19,036
2nd: Only keep CEO contracts	4,182
3rd: Only keep contracts with one-year vesting period	1,261

Panel E: Number of Unique Values

Level	Number
Firm	169
CEO	224
Contracts	691

3. Empirical strategy

The methodology applied in the results section of Chapter 3 closely follows the two-stage RDD regression setup used in Chapter 2. In the first stage of the RDD, the results from Chapter 3's Tables 3.3, 3.4, and 3.5 in columns (1) to (4) are identical to those from Chapter 2's Tables 2.4, 2.5, and 2.6. These results indicate that failing to meet RPE targets leads to increased CEO career concerns. The only difference between Chapter 2 and Chapter 3 lies in the inclusion of a more robust regression in column (5) of Chapter 3's Tables 3.3, 3.4, and 3.5.

In Chapter 3, we implement a global polynomial regression with 3 orders for RDD estimations, as depicted by Equation 3-1as below. This equation expands the regression discontinuity analysis by estimating a global polynomial series model. By incorporating polynomials of order three on both sides of the threshold, we conduct robustness checks.

$$y_i = \alpha + \beta_1 D_{ij} + \beta_2(x_{ij} - c) + \beta_3(x_{ij} - c)D_{ij} + \beta_4(x_{ij} - c)^2 + \beta_5(x_{ij} - c)^2 D_{ij} + \beta_6(x_{ij} - c)^3 + \beta_7(x_{ij} - c)^3 D_{ij} + \textit{controls} + \textit{fixed effects} + \varepsilon_i$$

Equation 3-1

Moving to the second stage of the RDD, the principal findings of this research are examined. This stage investigates the causal impact of career concerns on ESG reputational risk, which differentiates Chapter 3 from Chapter 2.

Overall, the methodologies of Chapter 2 and Chapter 3 are closely aligned, with the primary difference being the specific focus of the second-stage RDD regression. The first-stage regressions in both chapters confirm that missing RPE targets leads to heightened CEO career concerns, while the second-stage regression in Chapter 3 shifts to examine the effects of these career concerns on ESG reputational risk management.

4. Results

4.1. Missing the RPE target leads to higher CEO career concerns

As in Chapter 2, we first establish the randomness assumption of our RDD setting and then confirm that failing to meet the RPE target is an exogenous shock to CEO career concerns. We examine whether CEOs who narrowly fail to meet the RPE target experience a higher turnover rate and a higher ex-ante predicted dismissal probability in the subsequent year than their counterparts who just manage to beat the target.

Table 3.3 showcases the impact of missing the RPE target on the CEO's turnover in the subsequent year. Our results indicate that the CEO turnover rate increases by 6% after narrowly missing an RPE target. To ensure robustness, we include a global polynomial regression with 3 orders on the entire sample in column (5).

Table 3.3 Effect of CEO career concerns on CEO real turnover

	(1)	(2)	(3)	(4)	(5)
			Turnover T+1		
Below-cutoff	0.0614**	0.0644**	0.0652*	0.0583**	0.0312
	(2.2111)	(2.2456)	(1.9173)	(2.1709)	(1.1958)
Distance	0.2545	0.2747	-0.037	0.2233	0.0527
	(1.0146)	(1.0154)	(-0.0916)	(1.0586)	(1.3631)
Below-cutoff × Distance	-0.0803	-0.0846	0.488	0.0068	0.0025
	(-0.2348)	(-0.2351)	(1.0211)	(0.0238)	(0.0262)
Size		0.1304**	0.1196*	0.0823	0.0549
		(2.2054)	(1.9738)	(1.2754)	(0.8575)
MB		0.0202	-0.0085	-0.1311	-0.1424*
		(0.3549)	(-0.1619)	(-1.5667)	(-1.6680)
ROA		-0.1025	-0.1439	-0.0374	-0.0043
		(-0.5030)	(-0.7394)	(-0.1828)	(-0.0187)
CFO		0.3409	0.3432	0.6068	0.2756
		(0.7481)	(0.7266)	(1.3067)	(0.5216)
Lev		0.0665	0.0872	0.1296	0.1823
		(0.4427)	(0.6065)	(0.7929)	(1.0031)
z_X_2					-0.01
					(-1.3077)
I_z_X_2					0.0628
					(1.3503)
z_X_3					0.0004
					(1.1969)
I_z_X_3					0.0071
					(1.3033)
_cons	-0.0234	-1.2193**	-1.0811**	-0.9853	-0.4933
	(-0.4328)	(-2.4122)	(-2.0749)	(-1.6261)	(-0.8138)
N	1053	986	936	1023	1190
r2_a	0.0314	0.0406	0.0582	0.0497	0.062
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%	Global

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This table reports the effects of CEO career concerns on CEO real turnover. The dependent variable is the career-concerned CEO's real turnover in the subsequent year after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (normal bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). In column (5), we employ the global polynomial regression with 3 orders for RDD estimations as shown in *Equation 3-1*. Column (1) does not include control variables, while Column (2) to Column (5) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is β_1 *Below-cutoff*$_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that missing the RPE target leads to higher CEO real turnover, a key source of CEO career concerns.

In Table 3.4, we substitute CEO turnover with ex ante predicted dismissal probability and re-estimate the RDD regressions. The coefficients of interest remain significantly positive, signifying that the economic magnitude for the effect of missing the RPE target on predicted dismissal probability is slightly less than that for actual turnover.

Table 3.4 Effect of CEO career concerns on predicted CEO dismissal probability by logistic regression

	(1)	(2)	(3)	(4)	(5)
	Predicted CEO Dismissal Probability by Logistic Regression T+1				
Below-cutoff	0.0426**	0.0479**	0.0407**	0.0388**	0.0416**
	(2.1606)	(2.4315)	(2.2261)	(2.0881)	(2.3215)
Distance	0.2064	0.1409	0.2131	-0.0106	0.0234
	(1.2678)	(0.7445)	(0.7790)	(-0.0726)	(0.7118)
Below-cutoff × Distance	-0.2286	-0.0489	-0.499	0.0445	-0.0039
	(-0.7839)	(-0.1696)	(-0.9703)	(0.1826)	(-0.0371)
Size		-0.015	-0.0012	-0.0139	0.0054
		(-0.5431)	(-0.0335)	(-0.5113)	(0.1966)
MB		-0.0627	-0.0425	-0.0564	-0.0012
		(-1.5076)	(-0.7453)	(-1.3651)	(-0.0545)
ROA		-0.4027	-0.4141	-0.4061	-0.3751
		(-1.2934)	(-0.8822)	(-1.2782)	(-1.3269)
CFO		0.8119***	0.6558*	0.7675***	0.6524***
		(2.6419)	(1.8449)	(2.6761)	(2.7500)
Lev		0.4848***	0.2923*	0.4587***	0.4477***
		(3.8405)	(1.9194)	(3.5058)	(3.2082)
z_X_2					-0.0032
					(-0.7079)
I_z_X_2					0.0016
					(0.0249)
z_X_3					0.0001
					(0.6853)
I_z_X_3					-0.0019
					(-0.2546)
_cons	-0.0289	-0.0915	-0.1946	-0.0773	-0.2991
	(-1.0216)	(-0.3281)	(-0.5558)	(-0.2803)	(-1.1066)
N	898	835	764	866	1082
r2_a	0.0361	0.0963	0.0546	0.092	0.0774
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%	Global

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This table reports the effects of CEO career concerns on Predicted CEO Dismissal Probability estimated by Logistic Regression Out-of-Sample Prediction using a large set of firm-level characteristics from Compustat and CEO-level characteristics from BoardEx. Using the ex-ante predicted dismissal probability as a proxy for career concerns, this paper exploits narrowly missing the Relative Performance Evaluation (RPE) target as an exogenous shock to CEO career concerns in the RDD setting. The dependent variable is the career-concerned CEO's real turnover in the subsequent year after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al., (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth, as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (normal bandwidth) in column (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). In column (5), we employ the global polynomial regression with 3 orders for RDD estimations as shown in *Equation 3-1*. Column (1) does not include control variables, while Column (2) to Column (5) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is β_1 *Below-cutoff*$_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that missing RPE target CEOs can foresee their own turnover rate based on peers' turnover rate, another critical source of CEO career concerns.

Table 3.5 presents similar results using ridge regression with a penalty, further validating that missing the RPE target generates an exogenous shock to CEO career concerns. This suggests that CEOs who fail to achieve RPE targets adjust their expectations of dismissal risks based on their past observations of higher dismissal probabilities after missing the RPE target.

Overall, the regression results from this paper are consistent with those from Chapter 2, affirming the notion that CEOs are susceptible to termination following an unfavorable RPE outcome, which is often due to factors beyond their control. This aligns with the findings of Jenter and Kanaan's (2015) research. Our study enhances this perspective by employing an RDD, which effectively addresses potential endogenous issues related to the missed RPE targets serving as a source of CEO career concerns.

Table 3.5 Effect of CEO career concerns on predicted CEO dismissal probability by ridge regression

	(1)	(2)	(3)	(4)	(5)
	Predicted CEO Dismissal Probability by Logistic and Ridge Regression with Penalty T+1				
Below-cutoff	0.0353*	0.0449**	0.0352*	0.0433**	0.0432**
	(1.8173)	(2.2596)	(1.8879)	(2.1377)	(2.1749)
Distance	0.0745	0.1235	0.184	0.123	0.0442
	(0.5475)	(0.8298)	(1.0883)	(1.0779)	(1.4882)
Below-cutoff × Distance	-0.1561	-0.1781	-0.5031*	-0.1964	0.0059
	(-0.7079)	(-0.7860)	(-1.6998)	(-0.9995)	(0.0570)
Size		-0.0007	0.0074	0.0041	0.0235
		(-0.0273)	(0.2728)	(0.1503)	(1.2426)
MB		-0.0953	-0.0816	-0.0829	-0.0328
		(-1.4914)	(-1.2015)	(-1.2643)	(-1.1895)
ROA		-0.2676	-0.242	-0.2533	-0.2502
		(-0.9250)	(-0.8506)	(-0.8793)	(-0.9581)
CFO		0.7839***	0.8337***	0.7428**	0.5878**
		(2.6430)	(2.6273)	(2.5329)	(2.5049)
Lev		0.0787	0.1019	0.1268	0.1107
		(0.7121)	(0.9455)	(1.1070)	(0.8559)
z_X_2					-0.0062
					(-1.4741)
I_z_X_2					0.0175
					(0.3285)
z_X_3					0.0002
					(1.3875)
I_z_X_3					-0.0008
					(-0.1182)
_cons	-0.0414	-0.0295	-0.1432	-0.0986	-0.3271
	(-1.1568)	(-0.0922)	(-0.4465)	(-0.3079)	(-1.6078)
N	938	873	819	904	1082
r2_a	0.0687	0.099	0.1054	0.0946	0.0664
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%	Global

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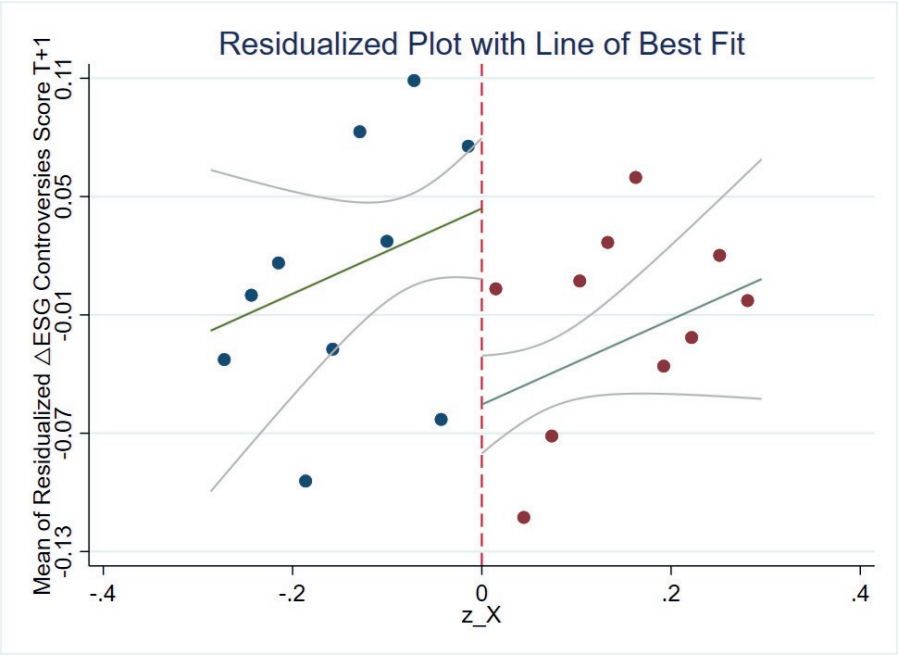
This table reports the effects of CEO career concerns on Predicted CEO Dismissal Probability estimated by Ridge Regression Out-of-Sample Prediction with L2 Penalty using a large set of firm-level characteristics from Compustat and CEO-level characteristics from BoardEx. Using the ex-ante predicted dismissal probability as a proxy for career concerns, this paper exploits narrowly missing the Relative Performance Evaluation (RPE) target as an exogenous shock to CEO career concerns in the RDD setting. The dependent variable is the career concerned CEO's real turnover in the subsequent year after they missed the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (standard bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). In column (5), we employ the global polynomial regression with 3 orders for RDD estimations, as shown in *Equation 3-1*. Column (1) does not include control variables, while Column (2) to Column (5) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta 1$ Below-cutoffi,t , which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% level, respectively. This table indicates that missing RPE target CEOs can foresee their own turnover rate based on peers' turnover rate, another critical source of CEO career concerns.

4.2. CEO career concerns lead to fewer ESG reputational risks

Next, we adopt a reduced-form RDD approach to examine the relationship between CEO career concerns and ESG reputational risks, which are captured by the Delta ESG controversies score. This score signifies the difference in ESG controversy scores between year T+1 and year T, as recorded by the Thomson Reuters Refinitiv database. A higher Delta ESG score corresponds to reduced negative scandal exposure in news media.

First, we present graphical evidence of a discontinuity in abnormal ESG reputational risk. We do this by plotting the means of the running variable - the difference between preestablished RPE goals and actual RPE outcomes - for each bin, along with fitted lines on both sides of the cutoff. We restrict our sample to grants where the running variable falls within data-driven narrow bands on either side of the cutoff. Figure 3.1 illustrates the impact of missing RPE targets on the residualized Delta ESG controversies score (which indicates the change in ESG reputational risk level), using the line of best fit. The plot reveals a significant discontinuity in ESG reputational risk around the cutoff, indicating that missing an RPE target has an economically significant effect of reducing ESG reputational risk.

Figure 3.1 Residualized plot with line of best fit



In Table 3.6, we then examine the effect of missing RPE targets on the Delta ESG controversies score using RDD. We run a similar series of RDD regressions as in Table 3.3, except we change the dependent variable from turnover to the Delta ESG controversies score. Our coefficients of interest (*Below-cutoff*) exhibit high statistical significance at the 1% level in each specification: excluding the control variable (Column 1), controlling firm characteristics (Column 2), changing RDD bandwidth to 75% (Column 3), and 125% (Column 4) of the optimal bandwidth, and using global polynomial RDD regression (Column 5). The economic magnitude of the coefficient ranges from 6.38% to 10.59%. These results suggest that career-concerned CEOs minimize ESG controversies to prevent further damage to their public image in the labor market following RPE failure.

Existing research indicates that ESG is gaining prominence among corporate managers, as it can contribute to building social capital (Lins et al., 2017). It is somewhat counterintuitive that CEOs experiencing career concerns after missing their primary RPE targets are more likely to reduce firm-level ESG reputational risk, thereby preventing the loss of social capital. A logical explanation could be that CEOs' career prospects are intrinsically linked to their firms' successes or failures. If CEOs are associated with failures in both RPE and ESG, their future career opportunities in the labor market may be severely compromised. Consequently, an optimal strategy employed by career-concerned CEOs may involve minimizing ESG reputational risk, thereby maintaining a positive image of the firms as sustainable in the long term despite the CEO's failure to achieve RPE targets. This outcome suggests that CEOs strategically reduce ESG reputational risk to limit the spread of potentially negative ESG criticism in the labor market.

Table 3.6 Effect of CEO career concerns on ESG controversies

	(1)	(2)	(3)	(4)	(5)
	△ESG Controversies Score T+1				
Below-cutoff	0.1011**	0.1059***	0.1025**	0.1017***	0.0638**
	(2.4453)	(2.7956)	(2.4973)	(2.9683)	(2.1733)
Distance	0.3876	0.4832	0.4243	0.2736	0.1652
	(1.2209)	(1.4721)	(0.8689)	(1.1082)	(1.0194)
Below-cutoff × Distance	-0.1424	-0.3468	-0.2917	0.0132	-0.2847
	(-0.2773)	(-0.6774)	(-0.4178)	(0.0339)	(-1.4013)
Size		0.0746	0.076	0.0797*	0.0549
		(1.6037)	(1.5504)	(1.7354)	(1.2090)
MB		0.2815***	0.2788**	0.2617**	0.1524
		(2.6831)	(2.5029)	(2.5762)	(1.2684)
ROA		-0.2612	-0.2594	-0.3167	-0.0179
		(-0.5715)	(-0.5560)	(-0.7069)	(-0.0393)
CFO		-2.1426***	-2.3459***	-2.0127***	-1.2482
		(-2.8016)	(-3.0575)	(-2.7169)	(-1.4430)
Lev		-0.2545	-0.2639	-0.2215	-0.2232
		(-0.6796)	(-0.6675)	(-0.6429)	(-0.7806)
z_X_2					-0.2176
					(-1.5779)
I_z_X_2					0.1616
					(1.0158)
z_X_3					0.0373*
					(1.8652)
I_z_X_3					-0.0447**
					(-1.9832)
_cons	-0.1233***	-0.8747**	-0.8675**	-0.9130**	-0.6401
	(-2.6728)	(-2.0075)	(-1.9908)	(-2.1999)	(-1.3308)
N	804	797	767	823	962
r2_a	0.0753	0.1213	0.1279	0.1212	0.0988
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	75%	125%	Global

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This table reports the effects of CEO career concerns on ESG controversies indicator drawn from the Thomson Refinitiv ESG Database. The dependent variable is career concerned CEOs' ESG controversies in the subsequent year after they missed the target of Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth, as shown in *Equation 2-5*. We report results across a variety of bandwidths, including 100% of optimal bandwidth (normal bandwidth) in columns (1) to (2), 125% of optimal bandwidth (narrower bandwidth) in column (3), and 75% of optimal bandwidth (wider bandwidth) in column (4). In column (5), we employ the global polynomial regression with 3 orders for RDD estimations, as shown in *Equation 3-1*. Column (1) does not include control variables, while Column (2) to Column (5) includes the control variables size, market-to-book, ROA, CFO, and Leverage. Our coefficient of interest is $\beta_1 \, Below\text{-}cutoff_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks $*$, $**$, and $***$ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that our results suggest that career-concerned CEOs who narrowly miss the RPE target suffer less from negative ESG media exposure in the subsequent year than otherwise similar CEOs who barely beat the target.

4.3. Heterogeneous analysis

In Table 3.7**,** we use RDD regression to estimate the interaction term coefficients between the missing target (below-cutoff) and earnings volatility (measured by ROA standard deviation, ROA range, ROE standard deviation, and ROE range within the next five years). In each regression from Columns 1 to 4, the coefficients of the interaction term are significantly positive, indicating that career-concerned CEOs who miss the RPE target in firms with higher financial risks are more likely to enhance their ESG reputations (corresponding to fewer ESG scandals). The economic magnitude of the coefficients of the interaction term ranges from 1.14% to 3.76%, suggesting that the effect of career concerns on ESG reputational risks is 1.14% to 3.76% higher for CEOs in firms with higher financial risks than for those in less risky firms.

Table 3.7 The interaction effect of firm financial risk

	(1)	(2)	(3)	(4)
	△ESG Controversies Score T+1			
Below-cutoff × ROA Standard Deviation	0.0376**			
	(2.2743)			
Below-cutoff × ROA Range		0.0202**		
		(2.2164)		
Below-cutoff × ROE Standard Deviation			0.0211***	
			(2.8953)	
Below-cutoff × ROE Range				0.0114***
				(3.0036)
N	680	709	770	797
r2_a	0.175	0.1664	0.1366	0.1303
Interaction Control	YES	YES	YES	YES
RDD Control	YES	YES	YES	YES
Control	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
RDD Optimal Bandwidth	100%	100%	100%	100%

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This table reports how firm financial risk affects the effects of career concerns on ESG controversies. The dependent variable is the career-concerned CEO's ESG and sub-sector indicators in the subsequent year after they miss the target set by Relative Performance Evaluation. Our coefficient of interest is the interaction term of β_1 *Below-cutoff*$_{i,t}$ ×*Financial Risk Indicators (captured by Return on Asset Standard Deviation, Return on Asset Range, Return on Equity Fluctuation Standard Deviation, Return on Equity Range).* Here, *Below-cutoff*$_{i,t}$ is a dummy variable that equals one for CEOs who miss their relative performance targets and zero otherwise, while financial risk indicators are numerical indicators. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results using 100% of optimal bandwidth (normal bandwidth). In the table, column (1) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Return on Asset Standard Deviation;* column (2) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Return on Asset Range;* column (3) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Return on Equity Fluctuation Standard Deviation;* column (4) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Return on Equity Range.* Each regression includes the control variables size, market-to-book, ROA, CFO and Leverage. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that the effect of RPE on ESG reputational risk is more pronounced for firms with higher financial risks.

In Table 3.8, we run similar RDD regressions with the interaction term between missing RPE target (below-cutoff) and stock price risks (including idiosyncratic risk, systematic risk, and total risk). Idiosyncratic risk measures firm-specific risks, while systematic risk captures market-level risks. Total risk encompasses both of these risks. Only the coefficient of the interaction containing idiosyncratic risk is highly significant and positive, while other indicators representing systematic risk or total risk are insignificant. The signs of the coefficients are all positive. The economic magnitude of the coefficients from Column 1 is 16.61%, suggesting that the effect of career concerns on ESG reputational risks is 16.61% higher for CEOs in firms with higher idiosyncratic risk than for those in less risky firms. Thus, the empirical results support our hypothesis that CEOs in riskier firms are more likely to capitalize on the altruistic value derived from a positive ESG reputation.

Our findings confirm that the relationship between CEOs' RPE tournament outcomes, CEO career concerns, and ESG reputational risk (as captured by ESG controversies) is more pronounced in riskier firms. One possible explanation is that the potential consequences of mismanaging ESG reputational risks may be more pronounced in riskier firms, as these riskier firms are more susceptible to adverse events. As a result, CEOs with heightened career concerns are more inclined to prioritize avoiding ESG reputational risks to safeguard their reputation and position. Moreover, the effect could be driven by the perception that companies with fewer ESG controversies are better managed and have a lower risk of encountering future problems. Therefore, if a CEO in a riskier firm can reduce ESG reputational risk, it could decrease the overall riskiness of the firm. In turn, effective ESG reputational risk management could significantly assist the CEO in securing their position within the company and potentially enhance their career prospects.

Table 3.8 The interaction effect of stock price risk

	(1)	(2)	(3)
	△ESG Controversies Score T+1		
Below-cutoff × Idiosyncratic Risk	0.1661**		
	(2.2742)		
Below-cutoff × Systematic Risk		0.0361	
		(0.4380)	
Below-cutoff × Total Risk			0.1141
			(1.3052)
N	665	665	665
r2_a	0.1343	0.1249	0.1288
Interaction Control	YES	YES	YES
RDD Control	YES	YES	YES
Control	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
RDD Optimal Bandwidth	100%	100%	100%

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This table reports how stock price risk affects the effects of career concerns on ESG controversies. The dependent variable is the career-concerned CEO's ESG and sub-sector indicators in the subsequent year after they miss the target set by Relative Performance Evaluation. Our coefficient of interest is the interaction term of β_1 *Below-cutoff*$_{i,t}$ ×*Stock Price Risk Indicators (captured by Idiosyncratic Risk, Systematic Risk, and Total Risk).* Here*, Below-cutoff*$_{i,t}$ is a dummy variable that equals one for CEOs who miss their relative performance targets and zero otherwise, while financial risk indicators are numerical indicators. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth as shown in *Equation 2-5*. We report results using 100% of optimal bandwidth (normal bandwidth). In the table, column (1) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Idiosyncratic Risk;* column (2) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Systematic Risk;* column (3) shows the interaction term is β_1 *Below-cutoff*$_{i,t}$ ×*Total Risk.* Each regression includes the control variables: size, market-to-book, ROA, CFO, and Leverage. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that the effect of RPE on ESG reputational risk is more pronounced for firms with higher idiosyncratic risks.

4.4. CEO career concerns are associated with lower ESG performance

In Table 3.9, we change the dependent variables to ESG performance, including delta ESG score, delta environment score, delta social score, and delta governance score, where "delta" indicates the difference between year T+1 and year T. The sign coefficients of interest (*Below-cutoff*) become negative, signifying that CEOs who miss the RPE target may enhance their ESG public images but actually decrease overall ESG performance. In particular, the delta governance score becomes significantly negative at the 10% level, implying that career-concerned CEOs who miss the target are likely to significantly reduce actual ESG engagement in the subsequent year. The economic magnitude of the coefficients reveals that career-concerned CEOs who miss the target show reduced delta ESG scores by 0.87% (column 1), delta environment subscores by 0.89% (column 2), delta social subscores by 0.52% (column 3) and delta governance subscores by 3.27% (column 4).

In summary, Table 3.9 shows that CEO career concerns do not improve ESG performance. Rather, career concerns correlate with lower engagement. This finding supports our hypothesis of an inverse relationship between career concerns and meaningful ESG outcomes. This implies that ESG reputational risk management takes priority over substantive ESG for career-concerned CEOs. Furthermore, our results likely stem from the trade-off between genuine ESG commitments and financial returns. Given limited time and resources, CEOs prioritize superficial signaling when facing significant career concerns, as it offers immediate career benefits. The signaling efforts take priority over resource-intensive ESG efforts with long-term payoffs.

Table 3.9 Effect of CEO career concerns on real ESG engagement

	(1) △ESG T+1	(2) △Environment T+1	(3) △Social T+1	(4) △Governance T+1
Below-cutoff	-0.0087	-0.0089	-0.0052	-0.0327*
	(-0.5962)	(-0.2682)	(-0.3223)	(-1.6734)
Distance	-0.0667	-0.2769	-0.0671	-0.1045
	(-0.7020)	(-1.3735)	(-0.6788)	(-0.6748)
Below-cutoff × Distance	0.0223	0.2775	-0.0757	0.1936
	(0.2025)	(1.4805)	(-0.6172)	(0.7479)
Size	0.0324*	0.0214	0.0374**	0.0277
	(1.7091)	(0.5827)	(2.3201)	(0.9036)
MB	-0.0251	0.0114	-0.0229	-0.0466
	(-0.8926)	(0.2655)	(-0.7018)	(-0.7203)
ROA	-0.0217	-0.0758	-0.0707	0.0806
	(-0.2277)	(-0.6486)	(-0.7513)	(0.4415)
CFO	-0.0703	0.0855	-0.0437	-0.2453
	(-0.4679)	(0.2871)	(-0.2321)	(-0.7618)
Lev	0.1326*	0.1468	0.1041	0.1465
	(1.6617)	(1.3207)	(1.0028)	(0.9265)
_cons	-0.3073	-0.2487	-0.3607*	-0.1921
	(-1.5697)	(-0.6660)	(-1.9609)	(-0.5914)
N	815	815	805	803
r2_a	0.1552	0.1743	0.1178	0.1314
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
RDD Optimal Bandwidth	100%	100%	100%	100%

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This table reports the effects of career concerns on ESG and its sub-sector indicators drawn from the Thomson Refinitiv ESG Database. The dependent variable is career concerned CEO's ESG and sub-sector indicators in the subsequent year after they miss the target set by Relative Performance Evaluation. We employ the nonparametric estimation method with optimal bandwidth to set RDD margins following Imbens and Kalyanaraman (2012) and Calonico et al. (2014). We first estimate the optimal bandwidth based on one standard MSE-optimal bandwidth selector. Then we run the local linear regression within the bandwidth, as shown in *Equation 2-5*. We report results using 100% bandwidth. In Column (1), the dependent variable is the change in ESG indicator. In Column (2), the dependent variable is the change in environment indicator, a sub-sector indicator of ESG. In Column (3), the dependent variable is the change in social indicator, a sub-sector indicator of ESG. In Column (4), the dependent variable is the change in governance indicator, a sub-sector indicator of ESG. Our coefficient of interest is β_1 *Below-cutoff*$_{i,t}$, which equals one for CEOs who miss their relative performance targets and zero otherwise. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics with standard errors clustered by firm. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗∗∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates no evidence that CEO career concerns could improve ESG performance. On the contrary, CEO career concerns actually reduce actual ESG engagement.

4.5. Further Discussion

Previous results indicate that career concerns lead to improved ESG reputational risk management but diminished ESG performance. It is also crucial to comprehend the significance of ESG for CEOs and examine whether ESG genuinely impacts a CEOs' turnover and their RPE results. Consequently, we conduct two sets of regressions in Table 3.10 and Table 3.11.

4.5.1. Effects of ESG on CEO turnover

In Table 3.10, we regress CEO turnover on firm-level ESG indicators. The results demonstrate that only ESG controversies scores are highly significant at the 5% level. The negative sign coefficients of interest (ESG controversies score) suggest that effective ESG reputational risk management leads to reduced CEO turnover. In other words, superior ESG reputational risk management results in lower CEO turnover. As CEOs aims to decrease their turnover rate, they endeavor to enhance their ESG reputational risk management (as captured by a higher ESG controversies score).

Table 3.10 Effects of ESG on real turnover rate

	(1)	(2)
	Real Turnover Rate T+1	
ESG Controversies Score	-0.0984**	
	(-2.2574)	
ESG		0.0230
		(0.2226)
_cons	0.1445**	0.0431
	(2.4623)	(0.5980)
N	1043	1043
r2_a	-0.0745	-0.0806
Year FE	Yes	Yes
Firm FE	Yes	Yes

This table reports how ESG affects the CEO's real turnover rate. The dependent variable is the CEO turnover rate in the current year. Our coefficients of interest are ESG Controversies Score and actual ESG performance. We report regression results after controlling for firm-level and year-fixed effects. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗ ∗ ∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that better ESG reputational risk management significantly leads to lower CEO turnover, but actual ESG performance may increase the CEO turnover rate. This table indicates that better ESG reputational risk management leads to better CEO relative performance evaluation (less likely missing RPE target).

4.5.2. Effects of ESG on missing RPE targets

In Table 3.11, we regress the indicator of whether the CEO misses RPE targets on firm-level ESG indicators. The results reveal that only ESG controversies scores are highly significant at 1%. The sign coefficients of interest (ESG controversies score) are negative, implying that effective ESG reputational risk management reduces the likelihood that CEOs will miss RPE targets. In other words, improved ESG reputational risk management leads to better CEO RPE, signifying a superior effect of the ESG controversies score in peer firm comparison. As the CEOs strive to maximize their probability of beating the RPE, they also make every effort to enhance reputational risk management (as captured by a higher ESG controversies score).

Table 3.11 Effects of ESG on missing RPE targets

	(1)	(2)
	Missing RPE Target T+1	
ESG Controversies Score	-0.3789***	
	(-4.5058)	
ESG		0.3197
		(1.5936)
_cons	0.6753***	0.1567
	(5.9661)	(1.1199)
N	1043	1043
r2_a	-0.0695	-0.0908
Year FE	Yes	Yes
Firm FE	Yes	Yes

This table reports how ESG affects the likelihood of the CEO missing the RPE target in the subsequent year. The dependent variable is the likelihood of the CEO missing the RPE target in the subsequent year, while the independent variable is the ESG Controversies Score or actual ESG performance in the current year. Our coefficients of interest are ESG Controversies Score and actual ESG performance. We report regression results after controlling for firm-level and year-fixed effects. Variable definitions are provided in Table 3.1. Numbers in parentheses are t-statistics. All t-statistics are reported in parentheses. The asterisks ∗, ∗∗, and ∗ ∗ ∗ denote statistical significance at the 10%, 5%, and 1% levels, respectively. This table indicates that better ESG reputational risk management significantly reduces the likelihood of the CEO missing RPE target, but actual ESG performance may increase the likelihood of the CEO missing the RPE target.

5. Conclusion

This study finds that career concerns prompt CEOs to manage ESG reputational risk more effectively. We employ RDD to identify the causal effect of CEO career concerns on firm-level ESG reputational risk management. In the RDD setting, we exploit narrowly missing the RPE target as an exogenous shock to CEO career concerns. Our baseline results show that narrowly missing the RPE target gives rise to CEO career concerns. These results are highly robust, using two proxies for career concerns: actual CEO turnover and ex ante predicted dismissal probability. Our reduced-form RDD results reveal that career-concerned CEOs who narrowly miss targets manage ESG reputational risk more effectively in the subsequent year. In line with economic intuition, our heterogeneity analyses suggest that the impact of CEO career concerns on improved ESG reputational risk management is more pronounced for firms with higher financial and idiosyncratic risks. However, there is no evidence that CEO career concerns enhance overall ESG performance. In contrast, CEO career concerns can diminish ESG performance due to CEOs' trade-off between managing ESG reputational risk and engaging in actual ESG activities.

Our findings are particularly significant in a society that demands corporate social responsibility. Our results indicate that career-concerned CEOs prioritize ESG reputational risk management, which yields immediate effects, while neglecting actual ESG engagement that necessitates long-term commitment. This paper introduces a novel RDD analysis framework to address the endogenous nature of career concerns in corporate finance research. This framework assists in understanding the causal impact of career concerns on CEOs' behaviors in the corporate financial decision-making process. Additionally, we provide an alternative measure for CEO career concerns using predictive CEO dismissal probabilities. Compared to actual turnover, our new measurement better captures latent career concerns and offers deeper insights into the drivers of CEO behavior. Third, we discover that career concern is an unobservable, force that is internally driven toward ESG reputational risk management. This finding lays the groundwork for further research on CEO behavioral tendencies, ESG engagement, and risk management.

Chapter 4 Director Nomination Eligibility Criteria and Stock Price Crash Risk*

We show that adopting director nomination eligibility criterion (DNEC) mitigates stock price crash risk. We hand-collect DNEC information from thousands of Chinese corporate charters and measure its impact on stock price crash risk over time. Nearby law office and the number of executives who are law alumni are used as two novel instrumental variables to establish a causal link between higher DNEC and lower stock price crash risk. Higher DNEC reduces stock price crash risk through reduced nomination threat, changed investor structure, a restructured board, and altered information disclosure transparency. This effect is more pronounced in nonstate-owned enterprises and firms with lower executive control, more volatile stock prices, and more retail investors.

Keywords:
Director Nomination Eligibility Criteria, Stock Price Crash Risk, Corporate Governance, China

JEL Classification:
G32; G34; G38

* This paper, co-authored with my PhD supervisors, has been invited for presentation at the 2023 China Corporate Finance Summer Forum and the 2023 Frontier on Corporate Finance and Capital Market Development in China-PBFJ Conference.

1. Introduction

1.1. Research question

In corporate finance, the participation of institutional shareholders in nominating directors is considered a basic form of investor engagement in a listed firm. This phenomenon revolves around the director nomination eligibility criteria (DNEC), which we define in this study as the shareholder eligibility criteria for director nominations that specify a minimum percentage and duration of share ownership required to nominate directors, as written in a corporate charter. For example, shareholders may be required to hold 5% of shares for 1 year before being eligible to nominate directors. The relationship between DNEC and institutional investors' behavior has attracted substantial attention from researchers due to its potential impact on the stock market.

Institutional investors, including hedge funds, private equity firms, and asset management companies, typically hold short-term perspectives on investment profits and become more active in corporate governance by intervening in the director nomination process (Black, 1997; Gillan and Starks, 2003; Hamdani and Yafeh, 2013). While some institutional investors assert that they should be eligible to make nominations, as they can promote corporate growth (Bebchuk et al., 2015; Squire, 2013; Vardi, 2009), critics argue that interventions by activist hedge funds may have a negative effect on the long-term interests of companies and their shareholders.

Particular attention is paid to activist hedge funds, which acquire small stakes, such as 1% or 2%, in a company's stock and push for measures that could quickly but unsustainably boost stock prices (Mizik, 2010; Pozen, 2018). Against this context, worth investigating is whether higher DNEC for shareholders could hinder short-term and activist investors from intervening in corporate governance. Especially in the current highly volatile stock market environment, the question arises as to whether higher DNEC could impact stock price crash risk.

1.2. Research hypothesis

Hypothesis 1: *Higher director nomination eligibility criteria reduce stock price crash risk.*

Based on this background, we hypothesize that higher levels of DNEC reduce stock price crash risk. Agency theory suggests that the separation of ownership and control in modern corporations leads to agency problems, as managers (agents) may engage in activities that are not value-maximizing for shareholders (principals) (Fama and Jensen, 1983; Jensen and Meckling, 1976). Although shareholders can exercise governance rights to discipline managers, dispersed ownership structures consisting predominantly of small individual shareholders impede effective governance, as they lack incentives and face coordination costs to actively monitor management (Gillan and Starks, 2000; Shleifer and Vishny, 1986). These dispersed owners are often short-term investors focused on quick returns rather than long-term value creation. DNEC represents a mechanism for a core group of committed long-term investors to overcome the obstacles of dispersed ownership by consolidating nomination rights. Raising the eligibility criteria for nominating directors deters dispersed short-term investors from intervening in the board's composition and corporate policies, enabling dedicated, long-term shareholders to exert greater governance. Consolidated governance rights bring stability to the shareholder base and facilitate long-term value creation, thereby reducing extreme stock price declines indicative of stock price crash risk. This is the rationale behind Hypothesis 1.

Hypothesis 2: *Higher DNEC mitigates stock price crash risk by adjusting the influence over nominations, optimizing the investor base, restructuring boards, and increasing transparency.*

Drawing on agency theory, we further hypothesize that higher DNEC enables concentrated long-term investors to influence governance and mitigate intense, short-term pressures through four interconnected channels that ultimately reduce stock price crash risk.

First, higher DNEC adjusts the balance of the influence over nominations between

short-term-focused and influential nonmajority shareholders and committed long-term, majority investors (Coffee Jr and Palia, 2016; Edmans, 2014). Agency theory suggests that dispersed, influential nonmajority shareholder investors with short investment horizons exacerbate agency conflicts by pressuring managers to pursue risky policies for short-term gains over long-term value creation. By raising director nomination thresholds, higher DNEC restricts the ability of these transient activist and influential nonmajority shareholders to nominate directors who push unsustainable measures to increase near-term share prices (Jensen and Meckling, 1976). Instead, higher eligibility criteria consolidate the nomination and oversight power with stable shareholders focused on long-term growth (Admati and Pfleiderer, 2009; Shleifer and Vishny, 1997). Concentrating nomination rights in this way helps resolve agency conflicts by empowering dedicated, long-term owners to nominate and oversee directors committed to sustainable value creation.

Second, by deterring short-term, speculative shareholders focused on temporary price spikes, higher DNEC cultivates a more stable, long-term-oriented investor base (Chen et al., 2006; Derrien et al., 2013; Gaspar et al., 2005). Agency theory contends that investors with short horizons compound agency problems by pressuring managers to take actions that unsustainably inflate near-term share prices, often through risky financial maneuvers, at the expense of prudent, long-term investments (Stein, 1989; Bushee, 2001). Given the reduced presence of such short-term-focused shareholders under higher DNEC, managers face less pressure to pursue potentially destabilizing actions aimed at maximizing quarterly earnings (Shleifer and Vishny, 1997), enabling them to focus on sustainable policies aligned with long-term growth. Additionally, long-term investors have greater economic incentives to actively ensure that management implements strong governance controls, regularly monitors risk exposure, and provides transparency—factors that help mitigate volatility and stock price crash risk (Ng et al., 2013; Singh and Davidson III, 2003).

Third, the concentrated director nomination rights facilitated by higher DNEC enable long-term investors to appoint board members focused on creating sustainable, long-term value rather than pursuing quick profits (Connelly et al., 2010; Masulis and Mobbs, 2014). Agency theory suggests that dispersed shareholders with short investment horizons incentivize directors to take actions that unsustainably boost short-term share

prices, exacerbating agency conflicts (Fama and Jensen, 1983). Given reduced short-term pressures under higher DNEC, directors are motivated to champion prudent, long-term growth opportunities and oversee the installation of risk management controls, even if doing so sacrifices near-term earnings volatility (Gormley and Matsa, 2016; Laverty, 2004). This stewardship of sustainable policies and governance systems aligned with long-term interests substantially reduces the likelihood of severe agency conflicts manifesting in share price crashes.

Finally, to maintain legitimacy and trust with dedicated long-term shareholders, the restructured board has a greater motivation to tangibly increase transparency through more detailed and accurate financial disclosures (Donnelly and Mulcahy, 2008; Khanna et al., 2004). Agency theory argues that information asymmetry between managers and shareholders enables agency conflicts (Jensen and Meckling, 1976). Increasing transparency through fuller disclosure helps resolve information asymmetry and associated agency costs. Transparency improvements under higher DNEC also curb speculative volatility that leaves firms prone to crash risk and provide investors with a better ability to gauge real, long-term progress, stabilizing valuations (Hutton et al., 2009a; Jiang et al., 2010). Taken together, the concentrated governance from higher DNEC enables long-term shareholders to resolve agency conflicts and reduce the associated instability that often precipitates stock price crashes. This is the rationale behind Hypothesis 2.

Hypothesis 3: *The effect of higher DNEC on reducing crash risk is more pronounced for firms with nonstate ownership, lower executive control, more volatile stock prices, and more retail investors.*

We further hypothesize that the impact of DNEC on the reduction of stock price crash risk is more pronounced in certain conditions. Specifically, we identify four factors that can intensify agency problems and information asymmetry: (1) nonstate ownership, (2) lower executive control, (3) more volatile stock prices, and (4) a higher proportion of retail investors. These four factors, derived from agency theory, are indicative of firms with weaker governance structures and higher stock price crash risk (Shleifer and Vishny, 1997; La Porta et al., 2000).

Agency theory suggests that ownership structure impacts the severity of agency conflicts (Jensen and Meckling, 1976). Specifically, nonstate-owned firms are less regulated and, hence, more susceptible to agency problems due to the separation of ownership and control (La Porta et al., 2002). Firms with lower executive control can experience greater agency conflicts, as executives might prioritize personal interests over shareholders' wealth maximization (Bertrand and Mullainathan, 2001).

Furthermore, information asymmetry is an important contributor to stock price crashes (Jin and Myers, 2006). Firms with volatile stock prices are prone to higher crash risk, as rapid price fluctuations can indicate underlying information asymmetry and mismanagement (Hutton et al., 2009). Such companies also exhibit larger information gaps between insiders and public shareholders. Retail investors, with less information accessibility and investment analysis expertise, exacerbate this asymmetry when they form a greater portion of a company's investors (Malmendier and Shanthikumar, 2007).

A higher DNEC, by discouraging short-term and activist investors and fostering long-term, informed decision making, can provide greater mitigating effects for these firms. Therefore, we hypothesize that the effect of DNEC on reducing crash risk is stronger for firms with these characteristics. This is the rationale behind Hypothesis 3.

In summary, our theoretical framework based on agency theory suggests that higher DNEC reduces stock price crash risk by adopting multiple steps to improve corporate governance. We hypothesize that higher DNEC (1) directly reduces stock price crash risk, (2) operates through four mechanisms, and (3) has a more pronounced effect in certain firm conditions exhibiting weaker governance structures. Testing these hypotheses provides evidence of the impact of DNEC on stock price crashes and enriches the understanding of DNEC as a corporate governance mechanism.

1.3. Institutional background

To test these hypotheses, we utilize the unique institutional environment in China, which provides an ideal setting for investigating the relationship between DNEC and stock price crash risk for several reasons.

1.3.1. Frequency and relevance of stock price crash risk

First, the Chinese stock market has experienced high volatility and frequent crashes over the years (Li et al., 2017; Xu et al., 2014). Unlike developed markets dominated by institutional investors, China's market has a high percentage of retail investors prone to speculation and herd behavior rather than fundamental analysis. This is partly due to the presence of many inexperienced individuals and information asymmetry stemming from weak corporate governance. Additionally, short-term speculation has occurred amid ongoing market reforms (Kennedy and Stiglitz, 2013; Mei et al., 2005). Given its history of volatility and the prevalence of crashes, China provides an apt setting in which to study the impact of DNEC on stock price crashes.

1.3.2. Stock market regulation

The regulatory environment in China is also distinctive. The China Securities Regulatory Commission (CSRC), the main regulator of the stock market, has been actively implementing policies to improve the corporate governance of listed companies and to protect the rights of influential nonmajority shareholders. However, investor protections and regulations in China remain weaker than those of developed markets (Firth et al., 2016). The regulatory oversight of listed firms continues to have gaps, and the enforcement of governance standards is limited (Allen et al., 2005). The relatively weaker investor protection provides more latitude for institutional investors to influence corporate policies, including through board representation, making the impact of DNEC more salient.

1.3.3. Corporate governance system

In China, domestic institutional investors have rapidly expanded and exert a growing influence over corporate governance (Jiang and Kim, 2015). Chinese hedge funds, private equity firms, and asset management companies often pursue short-term profits and actively intervene in companies to serve those interests, including pushing for board representation (Firth et al., 2016). While some argue that this activism promotes efficiency and growth, critics contend that it incentivizes detrimental policies that jeopardize long-term value and stability (Peng et al., 2011). This situation is

exacerbated by weak regulatory oversight in China that readily enables dominant institutions to shape corporate strategy to their near-term benefit (Peng et al., 2011). Furthermore, the risks of short-termism are heightened in China's mixed-ownership landscape, where state shareholders prioritize stability, while private institutions focus on immediate returns (Chen et al., 2010). This divide underscores the need to examine whether corporate governance measures such as DNEC—that limit certain shareholder rights—could improve long-term interests by restraining destabilizing activist interventions from domestic institutions. Empirical analysis can provide insights into this complex relationship between institutional investors and corporate governance that is specific to China's markets.

1.3.4. Investor types and structure

The investor structure in China is unique, with retail investors accounting for a significant portion of trading volume. These investors are typically short-term-oriented and lack the resources to monitor corporate actions effectively. On the other hand, institutional investors, such as investment banking firms, financial institutions that offer wealth management products, and private equity firms—although less numerous—are becoming increasingly influential and are often criticized for their short-term focus and activism (Jiang and Kim, 2015). The introduction of DNEC could counterbalance the influence of these investors by giving more control to long-term, committed shareholders. Furthermore and key to this study, DNEC has enabled changes in China that allow for empirical investigations. DNEC has gained prevalence as a dominant state, and institutional investors increasingly use it to consolidate control and thwart hostile takeovers amidst growing activism. The resulting variation in DNEC across firms and over time provides an opportunity to assess its impact on crash risk causally. Such changes in DNEC are not present in most other major markets.

In summary, the unique institutional setting of China, characterized by a high frequency of stock price crashes, a concentrated ownership structure, a distinctive regulatory environment, and a unique investor structure, makes it an ideal context for investigating the impact of DNEC on stock price crash risk. Our hypotheses are developed based on these institutional characteristics and the specificities of the Chinese stock market. This setting, although unique, shares similarities with other emerging markets, and our

findings may have broader implications beyond the Chinese context.

1.4. Research challenge

The institutional characteristics of the Chinese stock market make it an ideal setting for investigating the relationship between DNEC and stock price crash risk. However, empirically examining this relationship presents unique challenges.

1.4.1. Obtaining DNEC data

One key challenge to investigating the relationship between DNEC and stock price crash risk is obtaining detailed data on DNEC at the firm level. In the United States, the Securities and Exchange Commission (U.S. SEC) has implemented stringent restrictions on DNEC[1], making it difficult to investigate this issue empirically. In 2010, the U.S. SEC adopted proxy access rules that limit the right to nominate directors to shareholders who have held their shares for at least three years (SEC, 2010). Shareholders are required to hold a sufficiently large number of shares for a minimum holding period before using proxy access to nominate a director (Cohn et al., 2016), which ensures that directors are primarily nominated by long-term, accountable, and significant shareholders (Campbell et al., 2012). In contrast, the regulatory environment in China provides more latitude to examine changes in DNEC and their effects. In China, no explicit criteria exist for nominees regarding their shareholding percentage and period, according to *the Chinese Company Law* and *the Chinese SEC Guide on the Corporate Charter of Listed Companies*. Thus, we utilize the unique institutional advantage of the Chinese stock market to directly address the issue related to institutional investors' short-termism.

Capturing the director nomination eligibility criteria (DNEC) change over time is a significant challenge in investigating its corresponding impact on stock price crash risk in China's stock market. Although DNEC has been discussed in the legal literature, its impact on the stock market has yet to be empirically investigated in the finance literature. The primary reason for this could be that publicly listed firms in the U.S. are

[1] SEC Adopts New Measures to Facilitate Director Nominations by Shareholders: https://www.sec.gov/news/press/2010/2010-155.htm

currently prohibited from changing DNEC. We leverage the unique change in DNEC in China to address this research gap. However, even in China, it is not typical for listed firms to change DNEC, as doing so requires majority shareholder approval. Recent hostile takeover events in China, such as the "Board Directors Nomination Contest between Baoneng and Vanke," have led shareholders to realize that the nomination of hostile directors to the corporate board could lead to a significant loss in firm value. Accordingly, these shareholders have become more inclined to vote for the adoption of DNEC. As a result, more Chinese listed firms have adopted DNEC in their corporate charters by setting a higher threshold for the shareholding ratio and shareholder period. These newly implemented DNEC in corporate charters primarily target short-term and activist investors, providing a unique setting to investigate the change in shareholder nomination rights.

1.4.2. Analyzing millions of legal texts

The second challenge in investigating the impact of DNEC is the difficulty of extracting these provisions from corporate charters. Given that nomination rights are modified by changing the text of the charter, obtaining DNEC data requires analyzing legal documents. To address this, we collected Chinese corporate charters from 2009 to 2018 and developed a textual analysis system using Python to identify DNEC clauses based on linguistic patterns. Through iterative rounds of manual cross-checking and refinement, we ensured no errors and captured all DNEC provisions. This rigorous process yielded a high-quality, hand-collected dataset tracking DNEC changes, enabling examination of how enhanced nomination criteria impact crashes. By leveraging textual analysis and meticulous accuracy checks, we overcame the barrier of extracting DNEC data from charter legalese. Our dataset provides new firm-level insights into these opaque but important provisions.

In addition to legal text capture, it is also difficult to identify different forms of DNEC and consolidate them into a DNEC index that reflects the dynamic changes in the criteria over time. DNEC represents a special corporate charter provision in China that sets higher nomination criteria for eligible shareholders only when they reach a higher shareholding threshold and a more extended shareholding period. The traditional eligibility criteria for director nomination involve only a *three-percent shareholding*

threshold with no shareholding period requirement. The original intention of DNEC was to provide the incumbent director with more power to block hostile takeovers. However, corporate shareholders could set higher DNEC by heightening both *the shareholding ratio threshold* and *the length of the shareholding period*. Such higher DNEC alters the probability of a shareholder successfully nominating directors, potentially leading to unintended consequences for corporate governance, such as restructuring corporate boards. Given that both types of DNEC impede shareholders from nominating directors, we assign them equal weights, count the number of each type of DNEC, and combine these counts into a DNEC index. This index enables us to capture the change in DNEC over different periods.

1.4.3. Establishing causal link

The third challenge relates to the empirical difficulty of establishing a causal link between DNEC and stock price crash risk. Given that the adoption of higher DNEC in the corporate charter is endogenous and determined jointly by incumbent directors and shareholders, disentangling the effects of DNEC from other factors that may influence shareholders' approval to adopt higher DNEC is difficult. For instance, qualified shareholders or directors with idiosyncratic behavior may propose DNEC to be passed in a firm. More generally, the probability of setting higher DNEC in the corporate charter may be accompanied by unobservable changes in corporate strategy, governance, or preference that directly affect shareholders' approval to approve higher DNEC. In this context, determining whether any observed correlation between DNEC and stock crashes is caused by board director structure changes or other factors is difficult. To address this challenge, we develop two novel instrumental variables: the number of law firms located within 3 kilometers of a listed firm and the number of executives' alumni who graduated from law school. While having more law firms in close proximity increases a firm's likelihood of adopting higher DNEC, this factor is irrelevant to neighboring firms' stock price crash risk. Similarly, the number of executives' alumni with a professional legal background is positively correlated with the adoption of higher DNEC but does not affect the performance of peer firms' stocks.

1.4.4. Identifying underlying mechanism

The fourth challenge is the unclear mechanism behind the relationship between shareholder nomination rights and the stock crash phenomenon. To address this challenge, we employ regression analysis to test the potential mechanism between DNEC and stock crashes. Our baseline regression finds that higher DNEC reduces stock price crash risk, which is robust to various robustness checks, including Heckman's two-step sample selection model and an alternative sample. We further explore the economic mechanisms behind DNEC and find that they reduce the number of directors who tend toward financial disclosure opacity. Implementing DNEC also shields institutional investors and directors from institutional investors who are prone to short-termism and prefer to engage in corporate disclosure opacity that leads to stock crashes (Zhao, 2020). We also confirm that the impact of changes in DNEC on crash risk is more pronounced in firms without protection from SOE shareholders, firms with lower executive shareholding control levels, vulnerable firms with higher stock price volatility, and firms with more retail investors.

1.5. Research contribution

We substantially contribute to the literature on the dynamic impact of shareholder rights on corporate governance, the role of law in finance, stock price crash risk, and the behavior of activist institutional investors.

We contribute to the academic discourse on corporate governance and activist institutional investors by examining the relationship between DENC and stock price crash risk. Prior research conducted in the United States has suggested that a negative change in shareholder rights reduces firm value (Cremers and Ferrell, 2014) and increases the implied cost of equity (Chen et al., 2011a). However, those studies were conducted in a developed economy with strong shareholder protection. Recent research in China suggests that the effect may be different in countries with weak investor protection, where the quality of corporate decisions depends on the composition of influential nonmajority shareholders (Chen et al., 2013). We build on this suggestion by investigating the economic impact of higher DNEC—provisions that adjust shareholders' nomination rights. Simultaneously, we address a gap in the literature on

the role of activist institutional investors. Prior research has pointed out that influential investors and directors, through a short-termist approach, may advocate harmful strategies, such as the "pump and dump" scheme or "asset stripping" (Bebchuk et al., 2015; Brav et al., 2015), thus negatively influencing corporate disclosure opacity through board decision making. However, the impact of higher DNEC, which curtails institutional investors' sway over board decisions, remains underexplored. We provide direct evidence that higher DNEC could significantly lessen the presence of institutional investors and limit their potential for harmful interventions that affect stock prices. Thus, we offer a more comprehensive understanding of DNEC as corporate governance mechanisms and their interactions with institutional investors.

Second, we contribute to the literature on stock price crash risk, which is a crucial concern for investors due to the recent turbulence in the stock market. The determinants of stock crashes have been controversial, and most research has followed the theory of information asymmetries, which suggests that crash risk results from the asymmetry of information between corporate insiders and external stakeholders (Jin and Myers, 2006). Under asymmetric information, corporate insiders tend to hide bad news to minimize the adverse effects of bad news disclosures on their careers (Kothari et al., 2009). However, if this accumulated bad news is revealed to the market at once, stock prices continue to plummet, ultimately leading to a crash. In addition, corporate short-termism could lead to myopic behavior, such as abnormal accruals, earnings misreporting (Zhao and Chen, 2009), involuntary disclosure activity (Zhao et al., 2018), and managerial bad-news hoarding (Morck et al., 1990; Palepu, 1986). By avoiding corporate short-termism, internal incumbent directors or decision makers could reduce takeover threats (Chen et al., 2011; Gompers et al., 2003), disable the well-rounded market for corporate control (Jensen and Ruback, 2015), mitigate self-dealing managerial activities (Faleye, 2007), reduce information disclosure (Kothari et al., 2009), and finally withhold more bad news before a stock crash. Although the significance of stock price crash risk has been demonstrated in the previous literature, limited research has investigated the relationship between DNEC and stock crashes. We investigate the effect of DNEC on stock crashes by identifying the reduced number of directors in an asymmetric information environment using the financial opacity indicator to capture the asymmetry of information.

Third, we contribute to the interdisciplinary research between law and finance. The discriminatory nature of the DNEC provision has been criticized by some as it allegedly curtails shareholders' freedom to select their elected directors, thereby raising legal concerns (Butler, 2017; Hamermesh, 2014). Meanwhile, the traditional finance literature has shown that enhancing shareholder rights can help alleviate agency costs related to the separation of ownership and control (Chen et al., 2011; Gompers et al., 2003). In the legal literature, Bebchuk (2004) supports this view, arguing that empowering shareholders can incentivize managers to act in shareholders' interest, which reduces agency costs and improves corporate governance. However, Bainbridge (2006) questions the benefits of empowerment, suggesting that firms should preserve limited voting rights to maintain shareholders' current power, consistent with the principle of respecting the majority view. Bratton and Wachter (2010) argue that the recent global financial crisis exposes significant weaknesses in shareholder empowerment, as some shareholders focus too much on short-term share prices, ultimately generating more agency costs. As arguments exist for and against higher DNEC, determining whether shareholder empowerment benefits investors is ultimately an empirical question. We contribute to this debate by connecting the practice of law and empirical finance. We provide empirical evidence that higher DNEC improves information disclosure by reducing the number of directors representing aggressive institutional investors with short-termism, thereby highlighting a positive effect of DNEC on corporate governance.

The paper is structured as follows. Section 2 provides an overview of the research design. In Section 3, we present our baseline analysis. Robustness checks using different samples and methodologies are presented in Section 4. Section 5 provides an economic mechanism analysis and a detailed discussion of the threats posed by influential shareholders, short-term speculators, and directors with different backgrounds. Section 6 reports our findings on how the effects of DNEC vary across different contexts. Finally, Section 7 concludes our research.

2. Research design

2.1. Sample construction

Our sample consists of all firms listed on the Shanghai and Shenzhen Stock Exchanges from 2009 to 2018. We focus on this 10-year period for two reasons. First, starting the sample in 2009 avoids inconsistencies in variables from the 2005 split-share reform and 2008 financial crisis, which could otherwise skew the measurements. By excluding these years, we eliminate anomalous data. Second, the 2009–2018 period witnessed substantially increasing adoption of DNEC provisions across listed firms, providing useful within-sample variations and policy changes to rigorously estimate the impact of higher director liability exposure.

During the sample period, we manually collected data on the provisions of DNEC from all corporate charters issued by listed firms. We obtained the original corporate charters from CNINFO (http://www.cninfo.com.cn), a reliable official disclosure source designated by the China Securities Regulatory Commission (CSRC) for listed firms. Any amendment to a firm's charter must be disclosed on the CNINFO website. The process includes amendments proposed by board directors or shareholders, discussions in boardroom and shareholder meetings, and formal approval from shareholders' meetings before disclosing a new version of a corporate charter on CNINFO.

To construct crash risk, we used the weekly return data from the China Stock Market & Accounting Research (CSMAR) database during the same period. Similar to Xu et al., 2014b, we excluded firms with fewer than 30 trading weeks of stock return data in a fiscal year. Other control variables were obtained from corporate governance, stock transactions, and financial information datasets. Financial firms were excluded due to their differing accounting and financial reporting rules and capital structures compared to nonfinancial firms. After excluding samples with missing variables, our unbalanced panel data comprised 15,425 firm-year observations for 2009–2018, with 2,168 companies over 13 years.

2.2. Variable construction

2.2.1. Dependent variable: stock price crash risk

A growing body of literature has recognized the important implications of stock price crash risk in asset pricing models and portfolio theories (Kim and Zhang, 2016). Stock price crash risk is used as a proxy for extreme negative returns and measures the negative skewness in the distribution of individual stock returns (Callen and Fang, 2015; Chen et al., 2001; Kim and Zhang, 2014). The presence of negative skewness is considered a price risk factor in asset pricing because investors expect higher returns for stocks with more negative skewness (Conrad et al., 2013; Harvey and Siddique, 2000). In line with prior research (An and Zhang, 2013; Callen and Fang, 2013; Chen et al., 2001; Hutton et al., 2009; Jin and Myers, 2006b; Kim et al., 2011a, 2011b), we use two measures of firm-specific crash risk. Both measures are based on firm-specific weekly returns (denoted by *W*) estimated as the residuals from the market model. Using firm-specific returns ensures that our crash risk measures reflect firm-specific factors instead of broad market movements. Specifically, we estimate the following expanded market model regression:

$$r_{i,t} = \alpha_i + \beta_1 r_{M,t-2} + \beta_2 r_{M,t-1} + \beta_3 r_{M,t} + \beta_4 r_{M,t+1} + \beta_5 r_{M,t+2} + \epsilon_{i,t}$$

Equation 4-1

where $r_{i,t}$ is the return on stock *i* in week *t*, and $r_{M,t}$ is the return on the value-weighted market index in week *t*. The lead and lag terms for the market returns are included to account for potential nonsynchronous trading. Some stocks may not trade in every single period. By including leads and lags of the market returns, the regression better captures the complete comovement between the stock and the market index even if the stock did not trade concurrently (Dimson, 1979). This aligns the timing of the stock's returns with the corresponding market returns and provides a more accurate estimate of the stock's systematic risk and true correlation to the market, preventing nonsynchronous trading from distorting the results. The leads and lags are based on the expectation that stocks do not always trade synchronously with the market in each period. The firm-specific weekly return for firm *i* in week *t* ($W_{i,t}$) is calculated as the natural logarithm of one plus the residual return from Eq. (2), that is, $W_{i,t} = ln(1 +$

$\epsilon_{i,t}$).

Our first measure of stock price crash risk is the negative conditional skewness of firm-specific weekly returns over the fiscal year (*NCSKEW*). *NCSKEW* is calculated by taking the negative of the third moment of firm-specific weekly returns for each year and normalizing it by the standard deviation of firm-specific weekly returns raised to the third power. Specifically, we calculate the *NCSKEW* for each firm *i* in year *t* as

$$NCSKEW_{i,t} = -[n(n-1)^{3/2}\sum W_{i,t}^3]/[(n-1)(n-2)(\sum W_{i,t}^2)^{3/2}]$$

Equation 4-2

where *n* is the number of trading weeks on stock *i* in year *t*. A higher value for NCSKEW corresponds to a stock being more "crash-prone" and vice versa.

The second measure of stock price crash risk is the down-to-up volatility (*DUVOL*), which we calculate as

$$\mathrm{DUVOL}_{i,t} = \log\{[(\mathrm{n_u}-1)\sum_{\mathrm{Down}} \mathrm{W_{i,t}^2}]/(\mathrm{n_d}-1)\sum_{\mathrm{Up}} \mathrm{W_{i,t}^2}]\}$$

Equation 4-3

where n_u and n_d are the number of up and down weeks, respectively. A higher value of *DUVOL* indicates greater crash risk.

2.2.2. Test variable: director nomination eligibility criteria

Here, we defined the variable of higher DNEC (or DNEC as an abbreviation) as our variable of interest. Higher DNEC is a binary variable equal to 1 if a firm adopts DNEC by either raising the minimum shareholding ratio threshold or extending the minimum length of the shareholding period. The variable takes a value of 0 otherwise. To empirically examine the impact of higher DNEC on stock crash risk, we hand-collected a comprehensive dataset tracking DNEC provisions in Chinese firms' corporate charters from 2009 to 2018. Since nomination rights are modified by changing the charter text, analyzing the legal documents was necessary to obtain accurate DNEC data. We

scraped all corporate charters during this period from the China Securities Regulatory Commission's official disclosure website and matched them to firms to ensure complete, authoritative versions.

We then developed a rigorous textual analysis system leveraging Python to parse the lengthy charter documents. Specifically, we split the charter texts into individual sentences and programmed the system to scan each sentence for relevant linguistic patterns to identify DNEC clauses. To further validate the automated analysis, we manually and randomly cross-checked thousands of sentences to confirm that the system accurately captured all DNEC provisions without errors. Through multiple iterative rounds of automated scanning and manual verification, we eliminated any inaccuracies in identifying DNEC clauses.

This data collection yielded a comprehensive dataset tracing DNEC provisions from 2009 to 2018. To construct a DNEC index distinguishing higher versus lower criteria, we designated DNEC as 1 if a firm enacted any higher nomination criteria in a given year through increased thresholds or longer holding periods and 0 otherwise. The rationale is that a higher percentage and longer duration impose similarly more stringent requirements than does the 3% baseline threshold without a duration requirement. Since the goal is to examine the effect of tightening access, aggregating all forms of higher DNEC into a binary indicator captures the strengthening effect versus no change. Although an index could reflect the extent of tightening, the hypothesis concerns the impact of imposing higher barriers and not the marginal effect of further increasing them. A simple dummy variable avoids assumptions about the relative importance of higher percentages versus longer durations.

We cross-validated random firm-year DNEC values against the charters to ensure proper measurement. This verified firm-level DNEC dummy enables reliable empirical identification of the effect of heightening nomination criteria. By benchmarking against original charters, this verified DNEC dummy enables reliable empirical identification of the effect of strengthened nomination criteria. Comparing outcomes between higher- and lower-DNEC samples can estimate the impact of setting higher criteria. For instance, analyzing differential crash risk can evaluate whether setting higher DNEC mitigates stock plunges. The data construction and verified DNEC dummy are pivotal

for identifying the effects of setting higher DNEC.

2.2.3. Control variable

Consistent with the prior research on stock price crash risk, we incorporate firm-level control variables based on theoretical foundations that may impact crash risk. Specifically, we control for differences of opinion ($DTURNOVER_t$), stock volatility (SIGMA_t), stock returns (RET_t), size ($SIZE_t$), book-to-market ratio (BM_t), leverage (LEV_t), performance (ROA_t), and earnings management ($AbcACC_t$), as in the prior literature, associations between these characteristics and stock price crash risk have been established, which theoretically may confound the DNEC–crash relationship. For instance, high volatility and growth firms with low book-to-market ratios are prone to developing price bubbles that burst, leading to crashes. We do not control for governance or regulation, as the focus is isolating the effect of DNEC criteria changes rather than examining complementary mechanisms. Following established controls in the literature while narrowing to variables directly tied to crash theory provides disciplined isolation of the DNEC impact. The controls enable examining the DNEC–crash relationship above and beyond known alternative explanations.

$DTURNOVER_t$ is the detrended average monthly stock turnover in year t, calculated as the average monthly share turnover in year t minus the average monthly share turnover in year t − 1. Chen et al. (2011) adopt this variable to measure differences of opinion among investors because they find that it may be positively related to future crash risk.

As stocks with higher volatility are positively associated with future stock price crashes (Chen et al., 2001), we add the variable $SIGMA_t$, which represents the standard deviation of firm-specific weekly returns over fiscal year period t.

The predictive power of past returns can be explained by a bubble buildup as indicated by high past returns, followed by a significant price decline when prices fall back to fundamentals. We thus control for past returns (RET_t), calculated as the arithmetic

average of firm-specific weekly returns in year t.

The variable $SIZE_t$ is defined as the natural logarithm of the book value of total assets in year t. Previous empirical research reports a positive relationship between size and crash risk (Chen et al., 2001; Hutton et al., 2009b).

As firms with low book-to-market ratios could have more stochastic bubbles and higher crash risk (Chen et al., 2001), we control for the book-to-market ratio (BM_t), which is measured as the book value of equity divided by the market value of equity in year t.

In addition, we control for financial leverage (LEV_t), which equals the book value of total debt divided by the book value of total assets. The variable ROA_t is defined as net profit divided by the book value of total assets in year t. (Hutton et al., 2009b) show that financial leverage and operating performance are negatively related to crash risk.

As Hutton et al. (2009) find a positive association between earnings management and future crash risk, we control for abnormal accruals, a proxy for earnings management. We use the absolute value of abnormal accruals ($AbcACC_t$) in our regression analysis, calculated as the residuals from the modified Jones model (Dechow et al., 2015).

2.2.4. IV variable

The endogeneity concern arising from whether firms adopt higher DNEC could bias the estimates of causal effects in standard OLS regression. Endogeneity arises when the selection into treatment is influenced by unobserved heterogeneity across firms correlated with the error term, making DNEC an endogenous explanatory variable and biasing the coefficients. To address this concern, we employ two instrumental variables (IV) and use a treatment effects model following Heckman (1979) and Wooldridge (2010).

We utilize IVs that are exogenous and empirically correlated with a firm's propensity to adopt higher DNEC but do not directly determine stock price crashes. We argue that the adoption of sophisticated governance provisions such as DNEC inherently requires

specialized legal expertise. This process often begins as a substantive legal idea proposed by legal experts within or accessible to the firm. The provision then undergoes a rigorous drafting, review, debate, and voting process before final adoption. Firms are much more likely to undertake this legal process if they have meaningful access to the necessary legal resources and experts to facilitate adoption. Therefore, to rigorously address the endogeneity concern arising specifically from the adoption of higher DNEC levels, we propose two instrumental variables based on proximity to legal expertise.

2.2.4.1. Law office number nearby

The number of law firms within a 3-km radius of a listed firm's headquarters is our first instrumental variable for addressing endogeneity when estimating the effect of DNEC on crash risk. Using geographic proximity as an IV has sound rationales and follows an established methodology.

First, 3 km represents a reasonable distance for frequent in-person interactions and communication between companies and nearby legal experts. Law firms within a short traveling distance can provide legal consultations, review governance documents, attend meetings, provide legal opinions, etc. This level of substantive access facilitates knowledge transfer and shapes firms' propensity to adopt sophisticated governance such as DNEC.

Second, 3-km provides a tightly defined geographic zone that is large enough to capture sufficient law firms to meaningfully impact a firm's access to legal expertise but remains a narrow enough boundary to exclude law firms that are too geographically distant to exert substantive influence. The rationale for using 3 km is that this radius allows for feasible communication and engagement between firms and nearby law firms located in the same business districts. A 3-km distance serves as a conservative uniform baseline for accessible legal counsel across all locations. Because our goal is to define a consistent geographic zone in which accessible legal resources can plausibly impact a firm's governance practices but not maximize the law firm count, 3 km helps prevent overstating accessible legal resources while still capturing those within feasible scope to influence governance. This careful 3-km delineation prevents overstating accessible legal resources while still capturing the feasible scope of influence on a firm’s adoption

of higher DNEC.

Third, we construct this instrument using highly accurate and precise geospatial data on law firm locations obtained directly from Baidu Maps. The robust, granular data on geographic proximity strengthen the relevance of the IV by providing an accurate picture of legal resources within close interaction distances.

Fourth, while substantively easier access to specialized legal knowledge reasonably assists firms with adopting complex and nuanced governance provisions, sheer geographic proximity itself does not directly dictate or mechanically impact peer firms' future stock crash outcomes. This satisfies the key IV exclusion restriction criteria.

Fifth, previous literature has provided a precedent and methodological basis for using exogenous geographic factors as instrumental variables through a similar logic that physical proximity can influence an endogenous treatment without directly affecting the more distant outcome variable (Giroud and Mueller, 2010).

2.2.4.1. Executives' law school alumni number

Our second instrumental variable is the number of top executives at each listed firm who attended universities with Master of Laws (LLM) programs. The existence of specialized LLM degrees at executives' alma maters is a proxy for greater exposure to legal education and frameworks.

Specifically, we identify the undergraduate institutions for all top executives at each firm using public data on educational background in annual reports and biographies. For each of these institutions, we research whether structured LLM degree programs existed at the time the executive was a student.

We conjecture that executives attending universities with LLM programs are more likely to interact with and be influenced by legal academics and resources on campus. This facilitates a deeper understanding of legal frameworks relevant to governance, even without directly enrolling in law courses.

While exposure to legal education influences sophistication in provisions such as DNEC, the historical existence of LLM programs at executives' undergraduate institutions does not directly impact current stock price crashes.

To address endogeneity, we use two complementary instruments: law firm proximity leverages geographic data showing that legal access influences DNEC adoption, and executives' legal education proxies that exposure to legal frameworks shapes governance sophistication. Together, these instruments provide exogenous variations in DNEC based on access to legal resources and knowledge. Grounded in the corporate finance literature and causal logic, geographic and biographical instruments deliver a valid approach to tackling endogeneity without directly impacting crash outcomes.

A full description of the instrumental variables is provided in Table 4.1.

2.2.5. Mechanism variables

In this study, we utilize several key variables identified based on agency theory foundations to empirically test the four hypothesized mechanisms in Hypothesis 2 through which DNEC impacts stock price crash risk.

2.2.5.1. Influential investors

We utilize several key variables to capture the presence of influential nonmajority shareholders who could destabilize firms through activist interventions aimed at short-term gains. The variable Has_right reflects the number of shareholders who meet the criteria to nominate board directors. Three percent specifically measures shareholders who cross the 3% ownership threshold, giving them elevated voting rights, including director nomination privileges.

These variables directly quantify shareholders with clear abilities to nominate directors and influence board composition. By testing how DNEC impacts Has_right and Three_percent, we can examine whether DNEC reduces the number of influential nonmajority shareholders with nomination capacity. This examination provides insights into whether DNEC consolidates the influence over nominations among stable,

long-term investors and limits the power of destabilizing activists, as hypothesized.

In addition, Top2_9 aggregates the ownership percentages of the 2nd to 9th largest shareholders. A higher Top2_9 indicates a greater combined sway of influential nonmajority investors below the top largest shareholder. Meanwhile, the Z index captures gaps in voting power between the top two shareholders. A higher Z index implies that the top shareholder has disproportionate control compared to the second largest. Examining how DNEC affects Top2_9 and the Z index enables an assessment of whether DNEC consolidates power with the stable top shareholder relative to potentially disruptive nonmajority ones.

The reduced presence of influential nonmajority shareholders with elevated voting rights signifies that DNEC successfully concentrates its influence over nominations with accountable long-term investors and limits interventions from influential activist nonmajority shareholders. Testing these variables related to the distribution of influential nonmajority shareholders provides empirical evidence on whether DNEC deters destabilizing activism by short-term-focused shareholders, verifying the first mechanism in Hypothesis 2.

2.2.5.2. Institutional investors

We focus on several major types of institutional investors in China's markets to examine how DNEC impacts their presence and, thus, the balance between short- and long-term investors. The variables IBD Invest, Wealth Invest, and PE Invest specifically capture the percentage of shares held by investment banks, asset management products, and private equity funds, respectively. These financial institutional investors frequently engage in speculative, short-term-oriented practices such as activism aimed at temporary price spikes. In contrast, the variable Indus Invest measures the percentage of shares held by industrial corporations, which often adopt a long-term investment horizon. Testing how these ownership percentages change in response to DNEC provides insights into whether DNEC discourages short-term, speculative institutional investors while encouraging long-term, industrial strategic investors.

The reduced presence of short-term-focused financial institutional investors indicates

that DNEC improves stability by deterring destructive, short-term interventions. Meanwhile, increased industrial investment ownership implies the promotion of patient capital focused on sustainable growth. Examining the differential impact of DNEC on speculative short-term versus dedicated long-term institutional investors allows us to verify whether DNEC shifts the balance toward long-term interests, thereby improving corporate governance and mitigating crash risk. The ownership composition of different investor types is a key mechanism through which DNEC could impact stability. Therefore, these institutional ownership variables enable an empirical test of the hypothesized channels through which DNEC affects crashes, checking the second mechanism in Hypothesis 2.

2.2.5.3. Board composition

In this study, we utilize variables capturing the composition of corporate boards to examine how DNEC impact the expertise and orientations of directors. Specifically, Directors_MF and Directors_InvFirm quantify directors with mutual fund and investment firm backgrounds. These directors likely have extensive financial market expertise and connections with profit-seeking institutional investors. Meanwhile, Directors_FinMgmt reflects directors with financial management backgrounds who also tend to prioritize short-term financial performance.

Testing how DNEC affects the representation of these director types provides insights into whether DNEC reduces directors inclined toward short-termism, risky financial maneuvers, and close ties with speculative institutional investors—behaviors that could jeopardize stability. In contrast, Directors_BusMgmt measures directors with business management expertise pertinent to the company's industry and operations. These directors are more likely to champion prudent, long-term growth opportunities.

Examining how DNEC impacts Directors_BusMgmt enables an assessment of whether DNEC steers boards toward directors focused on sustainable value creation. Analyzing these variables representing director backgrounds elucidates whether DNEC restructures board composition in a manner that deters short-termism and promotes long-term interests. This provides a direct test of the hypothesized mechanism that DNEC reduces crash risk by optimizing board expertise and orientations away from

destabilizing financial speculation and toward judicious business development, validating the third mechanism in Hypothesis 2.

2.2.5.4. Transparency levels

We utilize the variable OPAQUE to capture financial transparency levels that can impact crash risk. OPAQUE measures the sum of a company's absolute discretionary accruals over the prior three years. Discretionary accruals quantify the portion of accruals in a company's reported earnings that stem from management judgment rather than normal business activities. Higher absolute discretionary accruals indicate greater distortions in financial reporting and opacity, allowing managers to manipulate earnings numbers or potentially hide negative information from shareholders.

Testing how DNEC affects OPAQUE provides direct insights into whether DNEC improves transparency and reduces management's ability to hoard bad news prior to crashes, as hypothesized. Reduced OPAQUE signifies that DNEC limits avenues for opaque financial reporting and discretionary accounting manipulation, thereby increasing overall financial statement transparency. Examining this key variable related to financial disclosure quality enables empirical assessments of whether enhanced transparency is a mechanism through which DNEC reduces destabilizing information asymmetry and mitigate crash risk, confirming the fourth mechanism in Hypothesis 2.

In summary, by utilizing these mechanism variables identified based on agency theory, we can empirically verify the four hypothesized channels through which DNEC affects corporate governance and crash risk, as outlined in Hypothesis 2. The mechanism analysis directly tests the theoretical links between DNEC and crash risk.

2.2.6. Heterogeneous variables

Hypothesis 3 conjectures that the effect of DNEC on mitigating crash risk is more pronounced under certain firm situations associated with more significant agency issues and information asymmetry. To test this hypothesis, the heterogeneous analysis utilizes variables identified in agency theory as indicators of higher crash risk vulnerability.

SOEs capture state ownership, which reduces agency costs. Non-SOEs are more prone to agency issues, so DNEC should have a greater impact on their crash risk.

Executives reflect insider ownership and control levels. Firms with lower executive control are more exposed to agency conflicts, suggesting that DNEC could provide larger risk reduction. CEO_Dual indicates CEO duality, which concentrates decision authority and increases agency costs. DNEC is expected to play a greater mitigating role in such firms.

Volatility measures stock return volatility relative to industry peers. DNEC should have a greater stabilizing effect on high-volatility firms more prone to crash risk. Retail_Investor captures the prominence of retail investors who contribute to mispricing and volatility. DNEC is likely more impactful on crash risk in firms dominated by irrational retail traders.

Analyzing the differential effects of DNEC based on these indicators of agency costs and information asymmetry provides a direct test of Hypothesis 3. The variables enable an examination of whether DNEC has a stronger mitigating impact on crash risk in firms where agency theory suggests that governance weaknesses and information gaps are more pronounced. Table 4.1 provides definitions of all variables used in our analysis.

Table 4.1 Variable definition

The variables employed in this paper are defined and sourced as follows. The dependent variable in our analysis is stock price crash risk, which is calculated as the standard deviation of daily stock returns during the previous year. The main independent variable is whether a firm adopts the provisions of Director Nomination Eligibility Criteria (DNEC), which is hand-collected data on the inclusion of DNEC provisions in firms' charters from CNINF (http://www.cninfo.com.cn), a website designated by the China Securities Regulatory Commission (CSRC) for information disclosure by listed companies in China. Firm-level characteristics and financial information are obtained from the China Stock Market & Accounting Research (CSMAR) Database, which is widely used in empirical studies of China's stock market.

Variable Name	Definition
Dependent variables	
- NCSKEW	The negative skewness of firm-specific weekly returns in year t + 1, calculated by taking the negative of the third moment of firm-specific weekly returns for each sample year and dividing it by the standard deviation of firm-specific weekly returns raised to the third power.
- DUVOL	The down-to-up volatility. For any stock i in year t, we separate all the weeks with firm-specific weekly returns below the annual mean (down weeks) from those with firm-specific weekly returns above the period mean (up weeks) and compute the standard deviation for each of these subsamples separately. We then take the log of the ratio of the standard deviation of the down weeks to the standard deviation of the up weeks.
Key variables	
- Higher DNEC	Higher DNEC is a binary variable equal to 1 if a firm adopts Director Nomination Eligibility Criteria (DNEC) by either raising the minimum shareholding ratio threshold, or by extending the minimum length of the shareholding period. The variable takes a value of 0 otherwise.
Instrumental variables	
- Law Office Number Nearby	The number of professional law firms within 3 kilometers of the listed firm
- Executives' Law Alumni Number	The number of Master of Laws enrolled at the university attended by executives of listed firms
Control variables	
- DTURNOVER	The detrended average monthly stock turnover in year t, calculated as the average monthly share turnover in year t minus the average monthly share turnover in year t − 1
- SIGMA	The standard deviation of firm-specific weekly returns over the fiscal year period t

- RET	The mean of firm-specific weekly returns over the fiscal year t
- SIZE	The natural logarithm of the book value of total assets in RMB in year t
- MB	Market-to-book ratio of equity of the company, calculated by the market value of equity divided by the book value of equity in year t
- LEV	Firm financial leverage, calculated by the book value of total debt divided by the book value of total assets in year t
- ROA	Return on assets, calculated by net profit divided by the book value of total assets in year t
- OPAQUE	The prior three years' moving sum of the absolute value of discretionary accruals (Hutton et al., 2009). Specifically, OPAQUE = AbsV ($DiscAcc_t$) +AbsV($DiscAcc_{t-1}$)+AbsV($DiscAcc_{t-2}$) where DiscAcct is measured using the Modified Jones Model
- Industry	Industry dummy
- Year	Year dummy
Mechanism variables	
- Has_right	The number of shareholders having the right to nominate directors
- Three_percent	The number of shareholders reaching the three percent threshold to be able to nominate directors
- Top2 9	The sum of the shareholding ratios of the top 2-9 shareholders. Shareholding ratio = the number of shares held by top 2-9 shareholders/total number of company shares.
- Z index	The larger the index, the greater the difference in shareholder power. Z index = the first largest shareholder's shareholding ratio / the second largest shareholder's shareholding ratio.
- IBD Invest	The percentage of shares held by investment banking firms
- Wealth Invest	The percentage of shares held by wealth management products issued by financial institutions,
- PE Invest	The percentage of shares held by private equity
- Indus Invest	The percentage of shares held by industrial investors
- Directors with Mutual Fund Background	The number of directors with a mutual fund background
- Directors with Investment Firm Background	The number of directors with an investment firm background
- Directors with Financial Management Background	The number of directors with a financial management background

- Directors with Business Management Background	The number of directors with a business management background
Heterogeneous variables	
- SOE	A dummy variable that takes the value of one if the company was a state-owned enterprise and zero otherwise.
- Executive	A dummy variable takes the value of one if the percentage of shares held by executives is greater than the sample median and zero otherwise.
- CEO Dual	A dummy variable that takes the value of one if the same person served as the CEO and Chair of the Board and zero otherwise.
- Volatility	A dummy variable takes the value of one if the standard deviation of the company's industry-adjusted stock return is greater than the sample median and zero otherwise.
- Retail investor	A dummy variable takes the value of one if the retail investor scale is greater than the sample median and zero otherwise.

2.3. Model specification

2.2.1. Baseline regression

The research question of this study aims to investigate whether stock price crash risk is associated with Higher DNEC and other control variables. The empirical model employed is represented by equation as below:

$$NCSKEW_{i,t+1}(DUVOL_{i,t+1}) = \beta_0 + \beta_1 \cdot Higher\ \ DNEC_{i,t} + \sum_{q=2}^{m} \beta_q \cdot (Control\ \ Variable_{i,t}) + \varepsilon_{i,t}$$

Equation 4-4

where β_1 represents regression coefficients. The term $\sum_{q=2}^{m} \alpha_q \cdot ControlVariable_{i,t}$ is the sum of the products of the coefficients α_q and their corresponding control variables for i firm at t time. These control variables are other factors that might influence whether a firm adopt DNEC in the sample. The $Control\ Variable_{i,t}$ here includes contains $DTURNOVER_t$, SIGMA$_t$, RET_t, $SIZE_t$, BM_t, LEV_t, ROA_t, $AbcACC_t$, year dummies, and industry dummies. $NCSKEW_{i,t+1}$ and $DUVOL_{i,t+1}$ measure stock price crash risk, whereas *Higher DNEC* represents the presence of *a higher Director Nomination Eligibility Criteria* written on the corporate charter. A negative (positive) β_1 indicates whether higher *DNEC* decrease (increase) stock price crash risk, while the sign of β_1 only suggests a correlation, not causation, between higher DNEC and stock price crash risk due to endogeneity bias and sample selection bias. ε_t is an error term. We show the definition of all the main variables in Table 4.1.

2.2.2. Heckman two-step sample selection model

We use the Heckman two-step sample selection model as a robustness check to control for potential selection bias. This model is particularly useful when the process of selection into the sample might be non-random, and hence, could potentially bias the estimates of the model. The Heckman procedure corrects for this bias by estimating the selection process and then including it in the main regression. The Heckman two-step

model consists of two parts: the selection equation and the outcome equation.

The selection equation is:

$$\widehat{Higher\ DNEC}_{i,t} = \alpha_0 + \alpha_1 \cdot IV_{i,t} + \sum_{q=2}^{m} \alpha_q \cdot ControlVariable_{i,t} + u_{i,t}$$

Equation 4-5

In this equation, $\widehat{Higher\ DNEC}_i$ is the predicted or estimated value of DNEC_i, the dependent variable in the selection equation. This variable represents estimated likelihood for whether a firm adopt higher DNEC or not. The term $\alpha_1 \cdot IV_{i,t}$ is the product of α_1 (a coefficient) and the Instrumental Variable (a variable that is correlated with $DNEC_i$ but not with $NCSKEW_{t+1}(DUVOL_{t+1})$). The instrumental variable is used to address potential endogeneity problems by providing exogenous variation in $DNEC_i$. The $u_{i,t}$ represents the error term in the equation. It captures the effect of all omitted variables that affect the firm adopting or not adopting DNEC in the model. This equation models the decision of a firm to adopt or not adopt DNEC in the sample (i.e., to have a $DNEC_i$ of 1). The coefficients α_0, α_1, and α_q are estimated using a Probit model, which is appropriate given that $DNEC_i$ is a binary variable.

The outcome equation is:

$$NCSKEW_{t+1}(DUVOL_{t+1}) = \beta_0 + \beta_1 \cdot \widehat{Higher\ DNEC} + \sum_{q=2}^{m} \beta_q \cdot Control\ \ Variable_t + \lambda \cdot IMR_t + \varepsilon_t$$

Equation 4-6

The outcome equation is similar to equation above, but with two differences. The first difference is the $\beta_1 \cdot \widehat{DNEC}$, this term is the product of a constant β_1 and the estimated or predicted value of DNEC from the selection equation in the first step of the Heckman procedure. The $\widehat{DNEC}$variable helps to correct for endogenous bias in the outcome of interest. The second difference is an additional term $\lambda \cdot IMR_t$, which is included in the

outcome equation to control for the endogeneity resulting from the s non-random selection process. Here, λ is the coefficient of the inverse Mills ratio (IMR), which is computed from the first step of the Heckman procedure. if λ is statistically significant, it suggests that there is selection bias in the sample, and the Heckman correction is necessary to obtain unbiased estimates. After controlling for endogenous and selection biases, the sign of β_1 suggest whether higher DNEC leads to stock price crash risk.

3. Baseline analysis

3.1. Descriptive statistics

Table 4.2 presents the descriptive statistics for the variables employed in our analysis. We split the sample into two groups based on whether a firm adopts a higher DNEC. Among all observations, 4226 DNEC provisions are found, while the remaining 11,199 observations belong to the non-DNEC sample. After dividing the sample, we conducted two-sample t-tests on the equality of means and medians for each variable to observe whether each variable exhibits a significant difference in relation to DNEC adoption.

In terms of dependent variables, we use NCSKEW and DUVO to measure crash risk. The means of the crash risk measures, NCSKEW and DUVOL, are -0.316 and -0.278, respectively, while the median values are -0.220 and -0.192. The mean and median values of NCSKEW and DUVOL differ between DNEC and non-DNEC firms. The significantly positive T-test statistics (Wilcoxon tests) confirm that DNEC firms exhibit lower stock price crash risk than non-DNEC firms. Given the significant differences between the firms that adopt and those that do not adopt a DNEC, further investigation is warranted to identify the causal impact of DNEC on stock price crash risk.

Consistent with prior literature, our study includes 8 control variables in all regression analyses. These variables cover various aspects of firm-level market information (*DTURNOVER, SIGMA, RET and MB*) and financial performance (*SIZE, LEV, ROA, and OPAQUE*). The descriptive statistics of these variables are in line with estimates from previous studies of the China Stock Market, such as those conducted by Xu et al., (2014) and Yuan et al., (2016). For example, the mean of de-trended average monthly stock turnover (*DTURNOVER*) is −0.033 for DNEC firms but -0.0493 for Non-DNEC

firms. The mean of firm-specific weekly returns is 0.0628 for DNEC firms and 0.0633 for Non-DNEC firms. The returns are 0.209 for DNEC firms and 0.139 for Non-DNEC firms. The firms in our sample have an average size of 15.72 for DNEC firms (15.76 for Non-DNEC firms), an average market-to-book ratio of 1.135 for DNEC firms (1.137 for Non-DNEC firms), an average leverage of 0.477 (0.462 for Non-DNEC firms), and an average return on assets of 0.0322 for DNEC firms (0.0311 for Non-DNEC firms). The prior three years' moving sum of the absolute value of discretionary accruals is 0.185 for DNEC firms (0.190 for Non-DNEC firms).

Table A in Table 4.3 provides the distribution of our sample firms based on their respective industries and year. Specifically, Table A displays the distribution of firms by industry according to the "guidance on the industry category of listed companies" issued by the China Securities Regulatory Commission (CSRC). Meanwhile, Panel B shows the distribution of our sample firms by year

Table 4.2 Descriptive statistics

The table presents the summary statistics for the sample period, grouped into two panels: firms with higher Director Nomination Eligibility Criteria (DNEC) and firms with lower DNEC. The variables used in this analysis are defined in Table 4.1.

	Higher DNEC firms *(DNEC=1)*				Lower DNEC firms *(DNEC=0)*				Differences *T-test*	
	Obs.	Mean	Median	sd	Obs.	Mean	Median	sd	Mean	Median
Dependent variables										
NCSKEW	4226	-0.316	-0.280	0.676	11199	-0.278	-0.242	0.684	0.037***	9.611***
DUVOL	4226	-0.220	-0.221	0.466	11199	-0.192	-0.190	0.474	0.028***	6.733***
Instrumental variables										
Law Office Number 3KM	4226	31.74	12	40.08	11199	29.79	12	37.76	-1.948***	0.805
Control variables										
DTURNOVER	4226	-0.0330	-0.0320	0.344	11199	-0.0493	-0.0460	0.344	-0.016***	7.757***
SIGMA	4226	0.0628	0.0570	0.0252	11199	0.0633	0.0580	0.0265	-	0.0310
RET	4226	0.209	0.0160	0.660	11199	0.139	-0.0440	0.631	-0.069***	40.446***
SIZE	4226	15.72	15.63	0.915	11199	15.76	15.65	0.972	0.041**	0.464
MB	4226	1.135	0.759	1.217	11199	1.137	0.736	1.240	0.00200	3.277*
LEV	4226	0.477	0.488	0.199	11199	0.462	0.459	0.205	-0.015***	28.997***
ROA	4226	0.0322	0.0310	0.0900	11199	0.0311	0.0320	0.0950	-0.00100	0.416
OPAQUE	4226	0.185	0.142	0.173	11199	0.190	0.143	0.190	0.00500	0.514
Mechanism variables										
shareholders with right	4221	2.442	2	1.535	11192	2.743	2	1.609	0.301***	104.091***
shareholders three percent	4221	2.503	2	1.541	11192	2.763	2	1.611	0.259***	76.928***
Z index	4226	16.31	5.210	38.67	11199	12.27	4.340	25.48	-4.039***	32.118***
Top10	4226	0.529	0.530	0.158	11199	0.555	0.557	0.152	0.025***	45.036***
Top2 5	4226	0.148	0.122	0.107	11199	0.165	0.148	0.108	0.018***	80.742***
Top2 9	4226	0.189	0.167	0.125	11199	0.211	0.197	0.125	0.023***	91.457***
Security firm ownership	4221	0.172	0	0.639	11192	0.192	0	0.774	0.0200	2.036

Wealth product ownership	4221	0.234	0	0.850	11192	0.291	0	1.899	0.057*	0.00100
PE ownership	4221	0.471	0	1.602	11192	0.643	0	1.948	0.172***	10.904***
Non-Finance ownership	4221	35.04	36.20	21.39	11192	34.55	35.96	22.99	-0.491	0.0760
Executive ownership	4036	0.0248	0	0.0808	10735	0.0454	0	0.125	0.021***	118.566***
Board ownership	4032	0.0473	0	0.119	10742	0.0890	0	0.169	0.042***	170.985***
Supervision ownership	3969	0.00110	0	0.00710	10562	0.00200	0	0.0100	0.001***	0.103
RETRAIL	4226	0.827	0.755	0.481	11199	0.722	0.631	0.454	-0.105***	151.717***
Dummy variables										
W index dummy	4226	1.468	1	0.499	11199	1.476	1	0.499	0.00700	0.627
X index dummy	4226	1.455	1	0.498	11199	1.472	1	0.499	0.017*	3.661*
SOE ownership dummy	4226	1.522	2	0.500	11199	1.494	1	0.500	-0.027***	-
Dual dummy	4170	0.181	0	0.385	11053	0.220	0	0.414	0.039***	27.767***
Management ownership dummy	4061	1.355	1	0.478	10820	1.446	1	0.497	0.092***	101.866***
Executive ownership dummy	4036	1.382	1	0.486	10735	1.452	1	0.498	0.070***	59.134***
Board ownership dummy	4032	1.360	1	0.480	10742	1.446	1	0.497	0.087***	89.901***
Supervision dummy	3969	1.500	1	0.500	10562	1.495	1	0.500	-0.00500	0.321
INSTI dummy	4221	1.634	2	0.482	11192	1.607	2	0.488	-0.027***	-
RETRAIL dummy	4226	1.545	2	0.498	11199	1.465	1	0.499	-0.080***	77.737***
stock volatility dummy	4226	1.393	1	0.488	11199	1.405	1	0.491	0.0120	1.900
ANALY dummy	4226	1.514	2	0.500	11199	1.542	2	0.498	0.028***	-
SELL dummy	4226	0.316	0	0.465	11199	0.325	0	0.468	0.00900	1.125

Table 4.3 Sample distribution

This table presents the distribution of sample firms across industries and years. Panel A shows the distribution of sample firms across industries based on the "Guidance on the Industry Category of Listed Companies'' issued by the China Securities Regulatory Commission (CSRC), where A=Agriculture, B=Mining, C=Manufacturing, D=Electricity, gas, and water, E=Building and construction, F=Transportation and logistics, G=Information technology, H=Commerce, I=Real estate, J=Service, K=Culture and media, L=Conglomerate, M=Science research, and technology service, N=Water conservancy, environment, and public facilities management, R=Cultural, sports and entertainment, S=Comprehensive. Panel B shows the sample distribution by year.

Panel A: Industry distribution

	A	B	C	D	E	F	G	I	K	L	M	N	R	S	Total
# DNEC=1	38	117	2484	211	79	311	171	244	290	81	22	59	50	69	4,226
# DNEC=0	174	338	6753	506	330	776	467	705	578	141	46	133	141	111	11,199
# Total	212	455	9237	717	409	1,087	638	949	868	222	68	192	191	180	15,425
% Total	1.4%	2.9%	59.9%	4.6%	2.7%	7.0%	4.1%	6.2%	5.6%	1.4%	0.4%	1.2%	1.2%	1.2%	100.0%

Panel B: Yearly distribution

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
# DNEC=1	377	373	393	393	426	473	484	505	483	319	4,226
# DNEC=0	588	660	751	809	948	1,233	1,354	1,459	1,548	1,849	11,199
# Total	965	1,033	1,144	1,202	1,374	1,706	1,838	1,964	2,031	2,168	15,425
% Total	6.3%	6.7%	7.4%	7.8%	8.9%	11.1%	11.9%	12.7%	13.2%	14.1%	100.0%

3.2. Baseline regression

According to our hypothesis developed in the introduction section, we hypothesize that a heightened level of DNEC moderates stock price crash risk. The agency theory indicates the inherent agency problems in modern corporations due to the separation of ownership and control, resulting in managers potentially engaging in nonvalue-maximizing activities for shareholders (Fama and Jensen, 1983; Jensen and Meckling, 1976). The predicament of dispersed ownership, primarily by small individual shareholders, hinders effective governance (Gillan and Starks, 2000; Shleifer and Vishny, 1986). Here, the DNEC acts as a tool for a select group of dedicated, long-term investors to counteract the challenges of dispersed ownership by concentrating on nomination rights.

The empirical evidence presented in Table 4.4, detailed below, supports this hypothesis and provides insights into the relationship between DNEC adoption and future stock price crash risk. Here, in this paper's analysis, two different measures of stock price crash risk, NCSKEW and DUVOL, are used as dependent variables in separate regression models. The baseline regression results in columns (1) and (3) indicate a statistically significant lower future stock price crash risk for firms that have adopted DNEC. Notably, the coefficients of the variable DNEC are negative in all models, implying economic significance. Specifically, the coefficients of DNEC in the initial ordinary least squares (OLS) regression models are -0.041 and -0.030, respectively, both statistically significant at the 1% level.

Furthermore, the negative relationship between DNEC adoption and future stock price crash risk remains robust after controlling for firm characteristics, as shown in Columns (2) and (4). The coefficients of the DNEC variable are -0.035 and -0.026 in the models controlling for firm characteristics, reinforcing the notion that DNEC adoption is associated with lower future stock price crash risk. Additionally, the control variables indicate that firms with higher returns, lower market-to-book ratios, and higher ROA are significantly associated with higher future crash risk, consistent with the findings in prior studies (Xu et al., 2014; Yuan et al., 2016).

These findings demonstrate that DNEC-adopted firms are less likely to experience

future stock price crashes, supporting our hypothesis. Moreover, they provide insights into the significance of firm characteristics in understanding stock price crash risk. Overall, our findings provide robust evidence that DNEC adoption, a mechanism that consolidates governance rights among dedicated long-term shareholders, is associated with lower future stock price crash risk.

Table 4.4 Baseline regression

This table reports a higher Director Nomination Eligibility Criteria (higher DNEC) on Stock Crash Risk. This table presents the results from the ordinary least squares regression of the impact of DNEC on future stock price crash risk. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1) F.NCSKEW	(2) F.NCSKEW	(3) F.DUVOL	(4) F.DUVOL
Higher DNEC	-0.041***	-0.035***	-0.030***	-0.026***
	(-3.079)	(-2.675)	(-3.279)	(-2.896)
DTURNOVER		0.011		0.009
		(0.438)		(0.540)
SIGMA		-0.804*		-0.529*
		(-1.931)		(-1.865)
RET		0.099***		0.069***
		(6.635)		(6.680)
SIZE		0.003		-0.012**
		(0.413)		(-2.246)
MB		-0.077***		-0.050***
		(-9.080)		(-9.069)
LEV		0.064		0.027
		(1.548)		(0.933)
ROA		0.390***		0.282***
		(2.632)		(2.653)
OPAQUE		0.059		0.033
		(1.350)		(1.207)
CONSTANT	-0.012	-0.173	-0.053	0.061
	(-0.235)	(-1.343)	(-1.477)	(0.672)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	12655	12655	12655	12655
adj. R^2	0.045	0.062	0.041	0.059
F	23.232	23.737	21.841	23.331

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4. Robustness checks

Our robustness checks address potential biases such as sample selection and endogeneity, which could bias the Ordinary Least Squares (OLS) estimation results. To validate our findings, we conduct robustness checks using various estimation samples and models that control for endogeneity. We aim to ensure our results hold true even when potential sample selection and endogeneity issues are considered. Thus, we apply a rigorous methodology involving a range of statistical techniques to verify the robustness of our findings.

4.1. Alternative sample

We conducted a series of robustness checks to examine the robustness of our results to different estimation samples. First, we investigated whether the presence of special treatment (ST) firms, initial public offering (IPO) firms, outliers, and the abnormal 2015 great crash in the China stock market affected our earlier findings. We present the results of our robustness checks for the full-model regression with DNEC as the dependent variable in Table 4.5.

To begin, we excluded ST firms from our sample to test the influence of these firms on our earlier results. According to Chinese Law, ST firms are constrained to daily share-price movements of 5% due to their negative net earnings for two consecutive years. As shown in columns (1) and (2) of Table 4.5, our regression results remained almost unchanged, indicating the robustness of our findings to alternative samples without ST firms.

Next, we excluded observations within their IPO year to alleviate concerns about potential problems of abnormal IPO effects. Newly listed stocks tend to experience more price fluctuations. As shown in columns (3) and (4) of Table 4.5, our regression results remained consistent, indicating the robustness of our previous findings to a different sample.

We also excluded 2015 observations to test whether the abnormal 2015 great crash in the China stock market unduly influenced our earlier results. The crisis triggered by the

bursting of the asset pricing bubble resulted in many stock crashes, which may have biased our estimation. The new results in columns (5) and (6) are qualitatively similar to those reported in the baseline regression of Table 4.5, indicating that our results are not driven by any exogenous shocks caused by the crisis.

Finally, we winsorized all variables at the bottom and top 1% points of their empirical distributions and estimated similar regressions in columns (7) and (8) of Table 4.5. The winsorization did not alter our statistical inferences, providing additional support for the robustness of our findings after excluding potentially extreme or outlier observations. Overall, our robustness checks suggest that our results are not driven by sample selection or endogeneity issues and are robust to alternative estimation samples.

Table 4.5 Robustness checks with alternative samples

This table presents the results from the ordinary least squares regression of the impact of Higher DNEC on future stock price crash risk. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Excluding ST Firms		Excluding IPO Firms		Excluding Year 2015 Observation		Winsorising top & bottom 1%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	F.NCSKEW	F.DUVOL	F.NCSKEW	F.DUVOL	F.NCSKEW	F.DUVOL	F.NCSKEW	F.DUVOL
Higher DNEC	-0.035***	-0.025***	-0.035***	-0.026***	-0.032**	-0.024**	-0.032**	-0.025***
	(-2.616)	(-2.764)	(-2.675)	(-2.896)	(-2.064)	(-2.270)	(-2.576)	(-2.884)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	12414	12414	12655	12655	9364	9364	12655	12655
adj. R^2	0.063	0.060	0.062	0.059	0.061	0.056	0.066	0.061
F	23.730	23.137	23.737	23.331	18.580	18.175	25.799	24.903

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2. Heckman two-step sample selection model

To address potential endogeneity issues, we conduct robustness checks using the Heckman two-step sample selection model. The underlying issue with DNEC is that a firm's decision to adopt a higher DNEC may be non-random and self-selected. Potentially omitted variables may influence the relationship between the treatment variable (adoption of DNEC) and the outcome of interest (stock price crash risk). Thus, we use the Heckman two-step sample selection model to control for endogeneity and attempt to identify the causal effect of the treatment variable (adoption of DNEC) on the outcome of interest (stock price crash risk).

To address endogeneity, we introduce the Law Office Number Nearby and the Executives' Law Alumni Number as two instrumental variables (IVs) in the Heckman two-step sample selection model. The first IV is based on the idea that firms with more legal resources nearby are more likely to understand and use DNEC, while DNEC is much less known to other firms far away from legal resources. The second IV idea is that executives with more legal experts in their alumni group are more likely to obtain legal suggestions to use DNEC. These two IVs meet both the relevance and exclusivity requirements of IVs. They are highly correlated with the independent variable (the firm's decision to adopt DNEC) and not directly correlated with the dependent variable (stock price crash risk). Furthermore, these two IVs impact stock price crash risk through whether or not the firm adopts DNEC.

In Table 4.6, we introduce the first instrumental variable (IV), "Law Office Number within 3KM around the focus firm," in the Heckman two-step sample selection model. In the first step, we estimate a Probit model with a binary DNEC dummy (which equals 1 if a firm adopts a higher DNEC, 0 otherwise) as the dependent variable. We add the IV and a series of determinants of DNEC adoption in the first step. The results of the first-step regression in columns (1) and (3) of Table 4.6 show that the number of law firms nearby (within 3 Kilometers) has a significant and positive impact on a firm's decision to adopt DNEC. These results are consistent with economic intuition. Since DNEC has legal effects once written in the corporate charter, firms' decision-makers with more legal expert resources nearby are more likely to understand and use this tool of law to protect themselves. Therefore, firms with more legal firms nearby tend to

adopt DNEC treatment, given that DNEC is less known to most firms.

Columns (2) and (4) show the second-step regression results. The estimation results in the first step generate a new Inverse Mills Ratio (IMR) variable that adjusts for endogeneity issues. We include the IMR variable in the second-step model to control for the potential sample selection bias. The second-step model's specification of other control variables is similar to the baseline model, as shown in Table 4.4. Columns (2) and (4) of Table 4.6 report the regression results of the Heckman model. The second-step regression results show that the coefficient of the variable DNEC remains significantly negative, regardless of whether the dependent variable is NCSKEW or DUVOL. These results confirm that DNEC leads to a lower level of future stock price crash risk after controlling for unobserved factors that may affect a firm's decision to adopt DNEC. Using the IV helps address potential endogeneity issues, providing more confidence in the causal relationship between DNEC adoption and future stock price crash risk.

The results of the two-step analysis presented in Table 4.6 provide several important findings. First, after controlling for endogenous issues, the DNEC treatment variable remains significant at the 1% level, indicating a robust causal relationship between DNEC and a reduction in stock price crash risk. Second, the coefficient of DNEC (-1.321) suggests that firms adopting a higher DNEC have a 132.1% lower stock price crash risk compared to firms without DNEC after controlling for endogeneity. Third, the IV approach with treatment-effect regression produces a substantially higher coefficient for DNEC compared to the standard OLS estimation. As evidenced in Column (2) of Table 4.6, the coefficient of DNEC (1.321) estimated by using an Instrumental Variable (IV) with a treatment-effect regression is notably higher than the coefficient (-0.035) estimated by using a standard Ordinary Least Squares (OLS) regression, as reported in Column (2) of Table 4.4. This finding suggests that the OLS estimation may underestimate the true impact of DNEC on stock price crash risk, as it does not account for endogeneity issues that may arise from unobserved confounding factors. Using an IV approach provides a more reliable and robust causal estimate of the relationship between DNEC adoption and stock price crash risk. Furthermore, our results are robust to changes in the dependent variable and suggest that DNEC reduces stock price crash risk after controlling for sample selection and endogeneity. These

findings offer consistent and compelling evidence for the effectiveness of DNEC as a tool to mitigate stock price crash risk in Chinese listed companies.

In Table 4.7, we present the results from running the Heckman two-step sample selection model using the executives' law-major college alumni number as another IV to control for potential endogeneity issues. The results from the first-step regression in columns (1) and (3) of Table 4.7show that the law alumni variable is negatively correlated with the firm's decision to adopt DNEC and has economic significance at the 1% level. This result is consistent with real-life situations where executives with more legal expert alumni connections in law firms may be more likely to use their connections to seek legal protection (such as DNEC) for themselves or their companies. Moreover, the law alumni variable does not directly correlate with stock price crash risk, indicating that it meets the IV requirement of exclusivity. Therefore, we use the law alumni variable as an IV in the Heckman two-step sample selection model.

Similar to the results in Table 4.6, the second-stage IV regressions in columns (2) and (4) of Table 4.7 show that the treatment variable of DNEC is significantly negative after controlling for endogenous issues. The results are consistent when changing the dependent variable to either NCSKEW in column (2) or DUVOL in column (4). These two-stage results suggest that adopting DNEC reduces stock price crash risk after using an alternative IV of executives’ law alumni number to control for endogenous issues. Overall, the results from the Heckman two-step sample selection model using two different IVs - Law Office Number Nearby and the Executives' Law Alumni Number - to address potential endogeneity issues are consistent and robust.

Table 4.6 Law office number 3KM nearby IV with treatment-effect regression on stock crash risk

This table shows the impact of higher Director Nomination Eligibility Criteria (higher DNEC) on stock crash risk. Column (1) to (4) of results is from the treatment effect model using the (Heckman, 1979) two-step consistent estimation method. The treatment-effects model considers the effect of an endogenously chosen binary treatment (adopt or not adopt a higher DNEC) on another continuous variable (stock crash risk in our study). In the first step, shown as columns (1) and (3), we estimate a probit model by including instrumental variable (IV) of law office number 3KM nearby. In the second step, shown as columns (2) and (4), we substitute the fitted probabilities for the treatment dummies in the standard OLS regression while including the inverse Mills ratio (namely Lambda or IMR) derived from the first-step probit regression as an additional independent variable. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1) Higher DNEC	(2) F.NCSKEW	(3) Higher DNEC	(4) F.DUVOL
Law Office Nearby 3KM	0.001**		0.001**	
	(2.316)		(2.316)	
Higher DNEC		-1.321**		-1.220**
		(-2.019)		(-2.444)
Invert Mills Ratio		0.775**		0.7194
		(1.966)		(2.393)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12655	12655	12655	12655

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.7 Law Alumni IV with treatment-effect regression on stock crash risk

This table shows the impact of higher Director Nomination Eligibility Criteria (higher DNEC) on stock crash risk. Column (1) to (4) of results is from the treatment effect model using the (Heckman, 1979) two-step consistent estimation method. The treatment-effects model considers the effect of an endogenously chosen binary treatment (adopt or not adopt a higher DNEC) on another continuous variable (stock crash risk in our study). In the first step, shown as columns (1) and (3), we estimate a probit model by including instrumental variable (IV) of the executives' law-major college alumni. In the second step, shown as columns (2) and (4), we substitute the fitted probabilities for the treatment dummies in the standard OLS regression while including the inverse Mills ratio (namely Lambda or IMR) derived from the first-step probit regression as an additional independent variable. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1) Higher DNEC	(2) F.NCSKEW	(3) Higher DNEC	(4) F.DUVOL
Law Alumni	-0.414***		-0.414***	
	(-3.915)		(-3.915)	
Higher DNEC		-1.044**		-0.736***
		(-2.541)		(-2.597)
Invert Mills Ratio		0.609**		0.428**
		(2.457)		(2.509)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12654	12654	12654	12654

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5. Economic mechanism

In the previous sections, we presented empirical evidence suggesting a statistically significant relationship between the adoption of DNEC and a reduction in future stock price crash risk. However, the exact mechanisms underlying this relationship remain unclear. We hypothesize that DNEC affects stock price crash risk through various channels. Specifically, we propose four potential mechanisms: (1) reducing the threat of shareholder activism, (2) altering the composition of investors with different investment horizons, (3) restructuring the board of directors to include members with different backgrounds and expertise, and (4) improving the transparency of information disclosure or reducing financial opacity. To investigate these potential mechanisms, we use the Baron and Kenny (1986) framework for mediation analysis and estimate regression models to examine whether these channels mediate the relationship between DNEC and stock price crash risk. By doing so, we aim to elucidate the underlying economic mechanisms linking DNEC to reducing stock price crash risk.

5.1. Balancing nomination power between influential nonmajority shareholders and majority shareholders

5.1.1 Mitigating nomination risk from active, influential nonmajority shareholders with over 3% shares

After adopting DNEC, incumbent executives may encounter fewer threats from potential new directors nominated by active shareholders. We consider this threat reduction as a critical channel for alleviating firms' stock price crash risk. To capture the threat reduction, we measure the number of shareholders with the right of DNEC, the number of shareholders with ownership reaching the 3% threshold, the ownership percentage of the largest 2 to 10 shareholders, and the ownership difference between the largest shareholder and the second-largest shareholder. These influential shareholders can potentially threaten existing directors and intervene in the existing corporate governance structure by nominating their directors. Accordingly, incumbent executives can use DNEC to disable unnecessary nominations, avoid potential conflicts, and thus reduce stock price crash risks.

To test this conjecture, we use the number of shareholders with the right of nomination (Has_right) as the first mediator in Panel 1 of Table 4.8. Column (1) reflects the regression of Has_right on DNEC and other control variables. The estimated coefficients on DNEC are negative and highly significant at the 1% level, implying that firms adopting DNEC reduce the number of shareholders with the right of nomination by 15.40% compared to those without DNEC. Columns (2) and (3) show that the DNEC variable remains significantly negative when we regress stock price crash risk on Has_right and DNEC as additional explanatory variables. This result indicates that DNEC reduces threats by decreasing the number of shareholders with the right of nomination. This channel is vital because influential shareholders could have the privilege of nominating new directors to replace existing directors. We also use the number of shareholders with three percent ownership (Three_percent) as an alternative mediator to measure threat reduction.

The results in Panel 2 of Table 4.8 suggest that DNEC reduces threats by decreasing the number of shareholders with influential voting rights, providing evidence for our conjecture that DNEC reduces stock price crash risks by reducing the power of those who previously had rights to nominate directors. The reduction in the number of shareholders with influential voting rights lowers the potential for conflicts and power struggles over the appointment of new directors. This finding is consistent with previous studies that highlight the importance of shareholder activism in corporate governance and the potential for such activism to be disruptive and destabilizing for firms. Together with the results in Panels 1 to 2 of Table 4.8, our findings support the view that DNEC is an effective tool for mitigating the risk of stock price crashes by reducing the power of influential shareholders and their potential for destabilizing interventions in corporate governance.

5.1.2 Enhancing the influence over nominations of majority shareholders

The results in Panel 3 of Table 4.8 also reveal statistically significant evidence that DNEC decreases the ownership concentration of the second to tenth shareholders. Specifically, the regression result in Column (7) demonstrates that the combined ownership percentage of the 2nd to 10th largest shareholders is significantly negative after DNEC adoption. This indicates a reduction in the influence of activist and

influential blockholder investors.

Furthermore, the two regressions results in Columns (8) and (9) demonstrate that the DNEC variable remains highly significant and negative, suggesting that DNEC reduces stock price crash risks by decreasing the power of influential blockholder shareholders. As these large investors have the potential power to threaten incumbent directors, our results confirm the hypothesis that DNEC reduces risks by limiting the influence of activist and influential blockholder shareholders.

We also utilize the ownership difference between the largest and the second-largest shareholders to verify our hypothesis, and the results are shown in Panel 4 of Table 4.8 The first regression in Column (10) reveals that DNEC is highly positive and significant when regressing the Ln_Z_index variable on DNEC while controlling for other variables, indicating that DNEC enables the majority shareholder to have more shares and power than the 2nd to 10th largest shareholders. The two regressions in Columns (11) and (12) demonstrate significantly negative coefficients, implying that DNEC reduces stock price crash risk by increasing the ownership gap between the majority and the 2nd to 10th largest shareholders.

The results from Panels 3 to 4 of Table 4.8 confirm our hypothesis that the increasing power of majority shareholders (or decreasing threats from influential shareholders) is crucial to DNEC reducing stock price crash risks.

Table 4.8 Mechanism: Adjusting the nomination power between the influential non-majority shareholders and majority shareholders

The table shows the mechanism of how DNEC reduces stock price crash risk. Panels (1) to (3) show that DNEC reduces stock price crash risk by reducing the number of influential shareholders, including those having nomination rights (Has_right), the number of shareholders reaching the three percent threshold to be able to nominate directors, the sum of the shareholding ratios of the top 2-9 shareholders. Panel (4) shows whether DNEC reduces stock price crash risk by increasing the majority shareholder's power relative to that of the influential non-majority shareholders (as measured by the first largest shareholder's shareholding ratio / the second largest shareholder's shareholding ratio). Columns (1), (4), (7), and (10) show how DNEC changes the threat from influential shareholders, while other columns show how DNEC reduces stock price crash risk while controlling the effects of influential shareholders. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Panel 1			Panel 2		
	(1)	(2)	(3)	(4)	(5)	(6)
	Has_right	NCSKEW	DUVOL	Three_percent	NCSKEW	DUVOL
Higher DNEC	-0.154***	-0.031**	-0.023***	-0.122***	-0.032**	-0.024***
	(-5.221)	(-2.362)	(-2.613)	(-4.110)	(-2.436)	(-2.685)
Has_right		0.031***	0.021***			
		(7.865)	(7.552)			
Three percent					0.032***	0.021***
					(8.044)	(7.674)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	12649	12649	12649	12649	12649	12649
adj. R^2	0.089	0.067	0.063	0.081	0.067	0.063
F	39.168	25.077	24.351	35.211	25.094	24.345

	Panel 3			Panel 4		
	(7)	(8)	(9)	(10)	(11)	(12)
	Top2_9	NCSKEW	DUVOL	Ln_Z_index	NCSKEW	DUVOL
Higher DNEC	-0.012***	-0.030**	-0.023**	0.076***	-0.032**	-0.024***
	(-5.134)	(-2.317)	(-2.549)	(3.653)	(-2.456)	(-2.693)
Top2_9		0.439***	0.289***			
		(8.468)	(8.255)			
Ln_Z_index					-0.040***	-0.025***
					(-6.550)	(-6.231)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	13257	12655	12655	12655	12655	12655
adj. R^2	0.090	0.068	0.064	0.059	0.066	0.062
F	43.776	25.193	24.644	25.564	24.412	23.841

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

5.2. Shifting investor structure toward long-term strategic preferences

5.2.1. Decreasing short-term speculative institutional investors

In general, investments made by investment banks, wealth management products, and private equity funds tend to be profit-driven and short-term-oriented. Short-term speculators may cause direct disruptions in stock prices. Accordingly, we hypothesize that DNEC reduces stock price crash risks by reducing the presence of institutional financial investors who tend to speculate on stock prices for short-term profit.

To test this hypothesis, we use IBD Invest, WMP Invest, and PE Invest to measure the percentage of shares held by short-term financial speculators, as shown in Panels 1, 2, and 3 of Table 4.9. The first-step regression results in Columns (1), (4), and (7) indicate that DNEC adoption significantly reduces the share held by short-term financial speculators, such as IBD, WMP, and PE investors. In Columns (2) and (3) of Panel 2, Columns (5) and (6) of Panel 3, and Columns (8) and (9) of Panel 4, our second-step regression results show that the negative effect of DNEC remains highly significant even after adding the percentages of shares held by IBD, WMP, and PE investors, respectively, in the corresponding regression results in Panels 2, 3, and 4. Taken together with the results of the first and second steps, our findings in Table 4.9 confirm our hypothesis that DNEC reduces stock price crash risks by decreasing the share held by short-term speculators, such as IBD Invest, WMP Invest, and PE.

Table 4.9 Mechanism: Changing the structure of investors with different preferences to short-term and long-term oriented strategies

The table shows the mechanism of how DNEC reduces stock price crash risk. Panels (1) to (3) show that DNEC reduces stock price crash risk by reducing institutional financial shareholders, including investment banking, wealth management product, and private equity. Panel (4) shows that DNEC reduces stock price crash risk by increasing industrial inventors. Columns (1), (4), and (7) show how DNEC reduces the threat level from institutional financial shareholders with short-termism, while (10) shows how DNEC helps firms obtain support from industrial investors with long-term oriented. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Panel 1			Panel 2		
	(1)	(2)	(3)	(4)	(5)	(6)
	IBD Invest	NCSKEW	DUVOL	WMP Invest	NCSKEW	DUVOL
Higher DNEC	-0.029**	-0.035***	-0.026***	-0.056***	-0.035***	-0.026***
	(-2.234)	(-2.682)	(-2.931)	(-2.633)	(-2.668)	(-2.912)
IBD Invest		0.018**	0.009			
		(2.255)	(1.594)			
WMP Invest					0.013**	0.008**
					(2.350)	(2.199)
PE Invest						
IND Invest						
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	12649	12649	12649	12649	12649	12649
adj. R^2	0.006	0.063	0.059	0.007	0.063	0.060
F	4.118	23.425	22.821	8.451	23.371	22.864

	Panel 3			Panel 4		
	(7)	(8)	(9)	(10)	(11)	(12)
	PE Invest	NCSKEW	DUVOL	Ind Invest	NCSKEW	DUVOL
Higher DNEC	-0.080**	-0.034***	-0.025***	0.749*	-0.035***	-0.026***
	(-2.420)	(-2.580)	(-2.849)	(1.905)	(-2.638)	(-2.887)
IBD Invest						
WMP Invest						
PE Invest		0.024***	0.013***			
		(6.992)	(5.593)			
IND Invest					-0.002***	-0.001***
					(-5.221)	(-4.453)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	12649	12649	12649	12649	12649	12649
adj. R^2	0.051	0.067	0.062	0.159	0.065	0.061
F	18.966	24.610	23.676	73.715	24.078	23.461

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.2.2. Promoting long-term industrial investors for sustainable business growth

Industrial investors are generally considered long-term-oriented; thus, we hypothesize that DNEC reduces stock price crash risk by increasing the percentage of shares held by such investors. To test this hypothesis, we use the variable *Ind_Invest* to measure the percentage of shares held by industrial investors, as shown in Table 4.9. Our results reveal a distinct pattern from that observed for short-term speculators. Specifically, the first-step regression results demonstrate that DNEC leads to a significant increase in industrial investment ownership. In the second step, both the variables *Ind_Invest* and DNEC are significantly negative at the 1% level, indicating that DNEC reduces stock price crash risk by encouraging higher ownership held by industrial investors.

In summary, our findings support the notion that DNEC adoption leads to a decrease in ownership held by short-term speculators, such as IBD, WMP, and PE, reducing stock price crash risks. In contrast, DNEC promotes a higher percentage of ownership by industrial investors, which could contribute to a decrease in stock price crash risks.

5.3. Restructuring board composition according to expertise and orientation

5.3.1. Limiting short-term-oriented directors from investment firms

The adoption of DNEC is expected to directly impact corporate board structure, which may indirectly affect stock price crash risk. For instance, directors from investment funds can indirectly influence stock prices by making decisions that affect financial performance stability and reporting disclosure. If such directors tend to make aggressive business decisions, push stock prices up, or engage in stock price speculation, doing so can lead to increased financial reporting opacity and possible stock price crash risk. We thus hypothesize that DNEC reduces stock price crash risk by reducing the number of directors on the board who are from mutual funds and investment firms.

We test this hypothesis, and the results are in Table 4.10. We regress the number of directors with different backgrounds on whether a firm has adopted DNEC. As expected, Panels 1 and 2 show that DNEC significantly reduces the number of directors on the board who are from mutual funds and investment firms. Specifically, in Column (1),

the DNEC variables are all significantly negative at the 1% level, indicating that DNEC reduces the number of directors from mutual funds. Similarly, in Column (2), the DNEC variables are also significantly negative at the 1% level when we use the number of directors from investment firms as the dependent variable.

Our four regression results in Panels 1 and 2 confirm that DNEC reduces directors from the financial investment industry who possess knowledge of the stock market and understand various techniques to push up the stock price in the short term. Such directors may be more susceptible to short-termism, as they tend to maximize short-term returns at the expense of long-term stability. This short-termism could be detrimental to a company's long-term stability, potentially leading to stock price crash risk.

Furthermore, in Panels 3 and 4, the variable for directors with a financial management background are introduced to demonstrate the impact of DNEC on the boardroom. The results in Column (7) show that adopting DNEC significantly reduces the number of directors with a financial management background, as such directors have a strong network of contacts with financial institutions and are more likely to pursue short-term profits.

5.3.2. Encouraging long-term-oriented directors with industry expertise

Directors with business management expertise are thought to better understand the long-term growth and stability of a company and its industry than are those with finance backgrounds who may have stronger connections with short-term, profit-oriented financial institutions. Therefore, we hypothesize that DNEC reduces stock price crash risk by reducing the number of boardroom directors with business management expertise.

In Panel 4 of Table 4.10, we find that adopting DNEC does not inhibit the appointment of directors with industry and business management backgrounds who can bring valuable experience and expertise to a company. In contrast, adopting DNEC increases the number of such directors. A possible explanation for this finding is that firms adopting DNEC may seek out directors with a wealth of knowledge about industry

practices and effective business strategies to help them improve their performance and achieve their goals. These changes are likely to benefit firms' long-term growth and success rather than simply boosting short-term stock prices that could result in the accumulation of the risk of stock price crashes.

Table 4.10 Mechanism: Restructuring director board members with different expertise and background

The table shows the mechanism of how DNEC reduces stock price crash risk. Panels (1) to (3) show that DNEC reduces stock price crash risk by reducing the number of directors with an investment and finance background, including mutual funds, investment firms, and financial management. Panel (4) shows that DNEC reduces stock price crash risk by increasing the number of directors with business management backgrounds with industry expertise. Columns (1), (4), and (7) show how DNEC reduces the number of directors with an investment and finance background, while (10) shows how DNEC increases the number of directors with a business management background. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Panel 1			Panel 2		
	(1)	(2)	(3)	(4)	(5)	(6)
	DIR_Fund	NCSKEW	DUVOL	DIR_Invest	NCSKEW	DUVOL
Higher DNEC	-0.001***	-0.035***	-0.026***	-0.001***	-0.036***	-0.026***
	(-3.319)	(-2.686)	(-2.902)	(-3.292)	(-2.720)	(-2.940)
DIR_Fund		-0.471	-0.309			
		(-0.852)	(-0.819)			
DIR_Invest					-0.596**	-0.424**
					(-2.207)	(-2.380)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	12655	12654	12654	12655	12654	12654
adj. R^2	0.002	0.062	0.059	0.010	0.063	0.059
F	3.244	23.092	22.686	4.538	23.126	22.788

	Panel 3			Panel 4		
	(7)	(8)	(9)	(10)	(11)	(12)
	DIR_Fin	NCSKEW	DUVOL	DIR_Bus	NCSKEW	DUVOL
Higher DNEC	-0.002**	-0.036***	-0.026***	0.004**	-0.035***	-0.026***
	(-2.490)	(-2.714)	(-2.924)	(2.133)	(-2.640)	(-2.856)
DIR_Fin		-0.281*	-0.168			
		(-1.732)	(-1.522)			
DIR_Bus					-0.074	-0.052
					(-1.081)	(-1.140)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	12655	12654	12654	12655	12654	12654
adj. R^2	0.023	0.063	0.059	0.128	0.062	0.059
F	11.607	23.166	22.677	53.007	23.052	22.686

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

5.4. Modifying transparency levels in financial disclosure

Previous studies have suggested that firms that hoard more bad news and exhibit lower transparency are more likely to experience stock price crash risk. We hypothesize that DNEC reduces stock price crash risk by improving financial transparency and reducing financial opacity. To test this hypothesis, we use financial opacity as a dependent variable and run regressions. The results are shown in Table 4.11. Our results in Column (1) indicate that the indicator variable of higher DNEC is highly significant at the 1% level, with a negative coefficient, suggesting that DNEC reduces financial opacity and makes it less likely for firms to hoard bad news. Furthermore, the results of our baseline regressions in Columns (2) and (3) show that DNEC continues to reduce stock price crash risk even after controlling for financial opacity, confirming our findings in Table 4.4.

Our results suggest that DNEC reduces threats by mitigating firm-level financial opacity, which can be attributed to active shareholders' influence in nominating directors to the board. Shareholders with a significant stake in the company have more votes and can nominate directors who are likely to promote financial transparency. Thus, firms that adopt DNEC are less likely to withhold bad news and face stock price crash risk, as they face less pressure from potentially active shareholders.

Our empirical findings validate our hypotheses, demonstrating that higher DNEC mitigates stock price crash risk through four interconnected mechanisms. This finding is consistent with agency theories suggested in previous literature, such as the works of Jensen and Meckling (1976). Specifically, higher DNEC diminishes the influence of short-term institutional shareholders, shifts the investor base toward a long-term orientation, enables long-term investors to nominate board members focused on sustainable value creation, and enhances financial transparency. These findings support the proposition that higher DNEC reduces agency conflicts and promotes long-term, sustainable growth, thereby reducing stock price crash risk.

Table 4.11 Mechanism: Altering the transparency level of financial information disclosure

This table reports a higher Director Nomination Eligibility Criteria (higher DNEC) on Stock Crash Risk. This table presents the results from the ordinary least squares regression of the impact of DNEC on future financial opaque. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1)	(2)	(3)
	F.OPAQUE	F.NCSKEW	F.DUVOL
Higher DNEC	-0.013***	-0.035***	-0.026***
	(-4.006)	(-2.675)	(-2.896)
OPAQUE		0.059	0.033
		(1.350)	(1.207)
Controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	12655	12655	Yes
adj. R^2	0.165	0.062	12655
F	32.216	23.737	0.059

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Heterogeneous analysis

Having established this economic mechanism, we now turn our attention to the potential heterogeneity of the impact of DNEC across different special situations. Accordingly, we further explore in this section the role of internal governance, market, and investor factors that may influence the relationship between DNEC and stock price crash risk.

6.1. Internal governance

Given Hypothesis 3, as shown in the research hypothesis section, the impact of DNEC on stock price crash risk may be more pronounced under certain conditions. We conjecture that this effect may vary across firms with different governance structures, particularly those characterized by nonstate ownership and lower executive control, as these factors have been identified as potential intensifiers of agency problems (La Porta et al., 2000; Shleifer and Vishny, 1997).

To test this hypothesis, we categorize our sample into two groups based on distinct levels of corporate governance and run separate regressions for each. Specifically, we stratify the subsamples based on whether the majority shareholder is a state-owned enterprise (SOE=1 or 0), the level of executive ownership (Executive=1 or 0, separated by the median value), and the presence of CEO duality, i.e., whether the CEO also holds the position of chairperson of the board (Duality=1 or 0). The results of these regressions are presented in Table 4.12.

The findings in Table 4.12 reinforce our Hypothesis 3. The data indicate that the effect of DNEC on reducing stock price crash risk is more significant in non-SOE and low executive ownership firms, conditions associated with weaker governance structures and higher crash risk (La Porta et al., 2000; Shleifer and Vishny, 1997) These results suggest that DNEC can indeed have a more substantial mitigating effect on firms with these characteristics, thereby corroborating our Hypothesis 3. Therefore, the results presented in Table 4.12 provide additional empirical support for our hypothesis that DNEC reduces crash risk more effectively in firms with nonstate ownership, lower executive control, higher stock price volatility, and a higher proportion of retail investors

Table 4.12 Heterogeneous analysis of corporate governance

The table shows that the effect of DNEC on stock price crash risk differs on different corporate governance, including majority shareholders' nature in Panel 1, executive shareholding level in Panel 2, and CEO duality status in Panel 3. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Panel 1 SOE		Panel 2 Executive		Panel 3 CEO Duality	
	(1) Small	(2) Big	(1) Small	(2) Big	(1) Small	(2) Big
Higher DNEC	-0.060***	-0.012	-0.035**	-0.006	-0.031**	-0.046
	(-3.149)	(-0.667)	(-2.052)	(-0.252)	(-2.128)	(-1.462)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	6289	6366	7054	5145	9987	2511
adj. R^2	0.062	0.063	0.065	0.058	0.065	0.045
F	11.984	12.892	14.400	9.851	19.829	4.719

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

6.2. Market and investor

Given Hypothesis 3, we conjecture that the effect of DNEC on stock price crash risk may be more distinctive under certain market and investor conditions. Specifically, we anticipate a stronger DNEC effect on firms with higher stock price volatility and a higher proportion of retail investors—conditions identified as potential contributors to information asymmetry and potentially increased crash risk (Jin and Myers, 2006; Malmendier and Shanthikumar, 2007).

To validate these conjectures, we partition our sample into separate subsamples characterized by different levels of market volatility and varying types of investors and run independent regressions for each. The subsamples are stratified by the median level of annual stock volatility for different markets and by the median proportion of retail (retail investor=1 or 0) and institutional investors (institutional investor=1 or 0) in the sample. The results of these analyses are presented in Panel 1 (market volatility), Panel 2 (retail investors), and Panel 3 (institutional investors) of Table 4.13.

The findings in Panel 1 of Table 4.13 align with our Hypothesis 3, showing that the DNEC effect on crash risk reduction is more significant in firms with higher stock price volatility. Furthermore, the results in Panels 2 and 3 indicate that this effect is more pronounced in firms with a larger number of retail investors and fewer institutional investors. These data lend further credibility to our hypothesis, given that such firms are more likely to experience price fluctuations due to the irrational trading behavior of retail investors (Malmendier and Shanthikumar, 2007).

In summary, the results in Table 4.13 provide empirical support for Hypothesis 3, demonstrating that the impact of DNEC on crash risk reduction is more substantial in firms characterized by higher stock price volatility and a larger proportion of retail investors.

Table 4.13 Heterogeneous analysis of stock characteristics

The table shows that the effect of DNEC on stock price crash risk differs on different stock characteristics, including volatility level in Panel 1, retail investors' shareholding level in Panel 2, and institutional investors' shareholding level in Panel 3. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	Panel 1 Volatility		Panel 2 Retail Investor		Panel 3 Institutional Investor	
	(1)	(2)	(1)	(2)	(1)	(2)
	Small	Big	Small	Big	Small	Big
Higher DNEC	-0.026	-0.052**	-0.015	-0.044**	-0.059***	-0.023
	(-1.502)	(-2.548)	(-0.760)	(-2.416)	(-2.622)	(-1.408)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	7641	5014	6327	6328	4763	7886
adj. R^2	0.073	0.051	0.082	0.054	0.056	0.071
F	17.434	8.427	16.361	11.455	9.507	17.310

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

7. Conclusions

In the current era of increasingly volatile stock markets, the risk of stock price crashes has emerged as a crucial area of investigation in corporate finance research. We present a hand-collected dataset of DNEC changes between 2009 and 2018 and examine their impacts on corporate governance. Our findings demonstrate that higher DNEC significantly reduces stock price crash risk. We report highly significant results that are robust to alternative sample checks. Additionally, we utilize two instrumental variables: the number of law firms within a 3-kilometer radius of a listed firm, and the number of executive alumni who majored in law in college. We use these variables to establish a negative causal relationship between DNEC and the risk of a stock price crash.

In our mechanism analysis, we demonstrate that DNEC reduces stock price crash risk through several channels: (1) mitigating the threat of influential shareholders' nominations, (2) decreasing the number of institutional financial investors that are oriented toward short-term profit and stock price speculation while increasing the number of industry investors with a long-term orientation, (3) reducing the presence of directors with finance backgrounds while increasing the presence of directors with business backgrounds who are capable of promoting business development, and (4) improving information disclosure. Our heterogeneous analysis further reveals that the effect of DNEC is more pronounced in firms that are non-SOEs, have lower executive control, experience more volatile stock prices and have a higher proportion of retail investors.

We contribute to the literature on shareholder rights, corporate governance, interdisciplinary research between law and finance, stock price crash risk, and institutional investors. Our findings complement the prior literature on the impact of shareholder rights on corporate governance (Chen et al., 2011; Chen et al., 2013; Cremers and Ferrell, 2014) and identify DNEC as a novel factor that can affect stock price crash risk, adding to the literature on stock price risk management (Jin and Myers, 2006; Kothari et al., 2009). The practical implication of our study is that publicly listed firms can use DNEC to prevent detrimental interventions by activist institutional investors, which ultimately reduces firm risk in the stock market.

8. Appendix

8.1 Further robustness checks

8.1.1 Alternative baseline regression - Higher DNEC with new control

To further validate the robustness of our findings, we conduct additional baseline regressions including two new control variables - CG_index and Market_index. CG_index is a corporate governance index calculated based on the method developed in previous literature on Chinese listed firms' corporate governance (Bai et al., 2005; Hong et al., 2018), with a higher index indicating stronger overall governance. Market_index captures the level of China's provincial marketization index developed by Wang et al., (2020) in the province where a firm is headquartered, with a higher value denoting a better market-oriented environment and legal regulatory environment. Controlling for these indices helps account for differences in broader governance quality and stock market institutions across firms that could potentially impact the relationship between DNEC and crash risk. The results are presented in Table 4.14.

The coefficients on DNEC remain negative and significant after including the new controls, consistent with our main findings. Higher CG_index is associated with lower crash risk, aligning with expectations. Greater stock market development (higher Market_index) corresponds to higher crash risk, likely due to greater volatility in more active markets. Overall, the persistent significance of DNEC in reducing crash risk even after controlling for provincial market development and composite governance index provides further confidence in the robustness of our original results. The additional controls do not substantively alter the DNEC coefficients or significance, reaffirming its impact on mitigating stock price crashes.

Table 4.14 Alternative baseline regression - Higher DNEC with new control

This table reports a higher Director Nomination Eligibility Criteria (higher DNEC) on Stock Crash Risk. This table presents the results from the ordinary least squares regression of the impact of DNEC on future stock price crash risk. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. The additional control variables are CG_index and Market_index. CG_index is a corporate governance index calculated based on the method developed in previous literature on Chinese listed firms' corporate governance (Bai et al., 2005; Hong et al., 2018), with a higher index indicating stronger overall governance. Market_index captures the level of China's provincial marketization index developed by Wang et al., (2020) in the province where a firm is headquartered, with a higher value denoting a better market-oriented environment and legal regulatory environment. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1)	(2)	(3)	(4)
	F.NCSKEW	F.NCSKEW	F.DUVOL	F.DUVOL
Higher DNEC	-0.041***	-0.030**	-0.030***	-0.022**
	(-3.079)	(-2.193)	(-3.279)	(-2.435)
CG_index		0.042***		0.027***
		(5.302)		(5.019)
Marke_index		-0.006		-0.007***
		(-1.544)		(-2.636)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	12655	12102	12655	12102
adj. R^2	0.045	0.065	0.041	0.061
F	23.232	22.649	21.841	22.156

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

8.1.2 Alternative baseline regression - Higher DNEC Shareholding Ratio

In our baseline regression, the variable Higher DNEC is a binary indicator capturing the adoption of any elevated director nomination eligibility criteria compared to the 3% baseline threshold. To examine whether the specific percentage threshold levels themselves affect crash risk, we replace this binary Higher DNEC variable with a continuous measure - Higher DNEC Ratio. Higher DNEC Ratio specifically quantifies the percentage shareholding threshold adopted by each firm for shareholders to be eligible to nominate board directors. A higher value denotes a more stringent percentage criterion above the common 3% baseline.

Our rationale for using this continuous percentage stake variable is to test whether the magnitude of the ownership criteria matters or simply having any higher threshold versus the common baseline is the main driver in reducing crash risk. If the specific percentage level itself is statistically significant with a negative coefficient, it suggests the particular threshold matters - that higher percentages correspondingly reduce crashes. On the other hand, if the variable is insignificant, it implies that merely having some higher threshold, irrespective of the exact level, is the key factor associated with lower risk.

In the regression analyses in Table 4.15, the coefficients on Higher DNEC Ratio are statistically insignificant across all models. However, the coefficients are consistently negative in sign. While not significant, the negative directionality aligns with the finding in our baseline regression that adoption of higher DNEC reduces future stock price crash risk. Despite the lack of statistical significance, the consistent negative signs provide corroborative evidence that more stringent percentage thresholds correspond to lower crash risk.

Table 4.15 Alternative baseline regression - Higher DNEC Shareholding Ratio

This table reports a higher Director Nomination Eligibility Criteria (higher DNEC) on Stock Crash Risk. This table presents the results from the ordinary least squares regression of the impact of Higher DNEC Shareholding Ratio on future stock price crash risk. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC Shareholding Ratio, which captures the minimum percentage of shares required for shareholders to be eligible to nominate directors. A higher ratio indicates more stringent criteria than the traditional 3% requirement for director nomination rights. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1)	(2)	(3)	(4)
	F.NCSKEW	F.NCSKEW	F.DUVOL	F.DUVOL
Higher DNEC Ratio	-0.023	-0.006	-0.015	-0.004
	(-1.238)	(-0.296)	(-1.189)	(-0.342)
CG_index		0.042***		0.028***
		(5.395)		(5.125)
Marke_index		-0.005		-0.006**
		(-1.423)		(-2.506)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	12655	12102	12655	12102
adj. R^2	0.044	0.065	0.041	0.061
F	22.969	22.554	21.456	22.013

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

8.1.3 Alternative baseline regression - Higher DNEC Shareholding Duration

Similarly, we examine the impact of the specific duration criterion by using the continuous variable Higher DNEC Duration. This measures the minimum shareholding period adopted by each firm for shareholders to be eligible to nominate directors, above the baseline of no duration requirement.

Our rationale for examining the duration length is analogous to the percentage threshold - we want to test if the particular duration magnitude matters or if simply requiring any longer holding period versus no baseline restriction drives the reduction in crashes. If the specific duration length is statistically significant with a positive coefficient, it indicates the exact length of time matters - longer durations incrementally reduce risk. If insignificant, it suggests merely requiring any holding period is the key factor associated with lower crashes, irrespective of the precise length.

In univariate regressions without controlling for other firm-level factors in Column (1) and (3) of Table 4.16, Higher DNEC Duration has positive coefficients. However, this likely reflects omitted variable bias. Once we include the full set of controls in the multivariate regressions, the coefficients turn negative, as shown in Columns (2) and (4) of Table 4.16. While statistically insignificant, the sign turn from positive to negative after adding controls implies that, when accounting for confounding factors, longer duration criteria correspond to marginally lower crash risk. This directionally aligns with the baseline finding that higher DNEC reduces crashes.

In summary, for Table 4.15 and Table 4.16, while the specific percentage criteria itself does not appear to directly determine the impact on crashes, the directional alignment lends credence to our baseline finding that imposition of higher nomination requirements mitigates crash risk. In addition, while the specific duration length does not appear to directly determine the impact on crashes, the directional alignment after including controls lends credence to our baseline result that restricting access to nomination rights reduces stock price crash risk. These results together provides supporting evidence that higher DNEC reduces stock price crash risk.

Table 4.16 Alternative baseline regression - Higher DNEC Shareholding Duration

This table reports a higher Director Nomination Eligibility Criteria (higher DNEC) on Stock Crash Risk. This table presents the results from the ordinary least squares regression of the impact of Higher DNEC Shareholding Duration on future stock price crash risk. The dependent variables NCSKEW and DUVOL are measured over year t + 1. The test variable is Higher DNEC Shareholding Duration, which indicates the minimum shareholding duration required for shareholders to be eligible to nominate directors. A higher value represents more stringent duration criteria adopted by the firm. Our regression model includes control variables, industry FE and year FE. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1) F.NCSKEW	(2) F.NCSKEW	(3) F.DUVOL	(4) F.DUVOL
Higher DNEC Duration	0.011	-0.013	0.009	-0.009
	(0.320)	(-0.364)	(0.380)	(-0.342)
CG_index		0.043***		0.028***
		(5.403)		(5.133)
Marke_index		-0.005		-0.006**
		(-1.427)		(-2.508)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	12655	12102	12655	12102
adj. R^2	0.044	0.065	0.041	0.061
F	22.878	22.536	21.365	21.994

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

8.1.4. Alternative Heckman two-step sample selection model - Law office number 5KM nearby

In Table 4.6, we use the number of law firms within 3km of a listed firm's headquarters as an instrumental variable to establish the causal impact of higher DNEC on reducing stock price crashes.

As an additional robustness check, we use an alternative geographic boundary of 5 km to calculate the number of nearby law firms as another instrumental variable. This captures a broader zone of accessible legal expertise that could influence a firm's propensity to adopt heightened director nomination criteria. We control for additional variables, including the corporate governance index (CG_index) and China's provincial marketization index (Market_index), similar to other regressions shown in the Appendix. The results are shown in Table 4.17. In the first stage regressions, the number of law offices within 5km (Law_Office_5km) is positive and statistically significant. This aligns with the findings in Table 4.6, confirming that greater proximity to legal resources increases the likelihood of firms adopting higher DNEC.

In the second stage results of Table 4.17, the coefficients on higher DNEC remain negatively signed after instrumenting with Law_Office_5km, consistent with our main results that higher DNEC reduces future stock price crash risk. However, the coefficients are statistically insignificant in the second stage. The lack of significance may result from weaker relevance of the 5km boundary compared to the more proximate 3km zone used in Table 4.6. The broader 5km area could include some law firms that are less substantively influential, weakening the instrument relevance.

However, the directional consistency of the DNEC coefficients after instrumenting with 5km law firm proximity further corroborates the negative relationship found in our main analysis. Despite the statistical insignificance, it provides additional evidence supporting a causal impact of higher DNEC on mitigating stock price crashes.

In summary, while not significant, instrumenting DNEC with 5km law firm proximity yields directionally consistent results, complementing and lending further credibility to the main findings in Table 4.6. The alignment shows the negative effect of higher

DNEC on crashes is robust to alternative geographic IV specifications.

Table 4.17 Law office number 5KM nearby IV with treatment-effect regression on stock price crash risk

This table shows the impact of higher Director Nomination Eligibility Criteria (higher DNEC) on stock crash risk. Column (1) to (4) of results is from the treatment effect model using the (Heckman, 1979) two-step consistent estimation method. The treatment-effects model considers the effect of an endogenously chosen binary treatment (adopt or not adopt a higher DNEC) on another continuous variable (stock crash risk in our study). In the first step, shown as columns (1) and (3), we estimate a probit model by including instrumental variable (IV) of law office number 5KM nearby. In the second step, shown as columns (2) and (4), we substitute the fitted probabilities for the treatment dummies in the standard OLS regression while including the inverse Mills ratio (namely Lambda or IMR) derived from the first-step probit regression as an additional independent variable. The asterisks of *, **, and *** indicate significance at the 10%, 5%, and 1% levels (two-tailed), respectively. Reported in parentheses are t-values based on robust standard errors clustered by firm. All variables are defined in Table 4.1.

	(1) Higher DNEC	(2) F.NCSKEW	(3) Higher DNEC	(4) F.DUVOL
Law Office Nearby 5KM	0.000*		0.000*	
	(1.761)		(1.761)	
Higher DNEC		-0.237		-0.194
		(-0.499)		(-0.599)
Invert Mills Ratio		0.024		0.017
		(0.832)		(0.899)
CG_index	-0.094***	0.035**	-0.094***	0.022*
	(-6.153)	(2.143)	(-6.153)	(1.936)
Marke_index	-0.056***	-0.010	-0.056***	-0.010
	(-8.229)	(-0.996)	(-8.229)	(-1.515)
Controls	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12102	120102	12102	12102

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

8.2 Further background

8.2.1 Real-world cases of adopting higher DNEC

The Vanke Case

Between 2015 and 2017, Vanke, a leading Chinese real estate developer, became embroiled in a prolonged hostile takeover battle. The conflict was instigated when a relatively unknown Chinese activist investor, the Baoneng Group, began quietly acquiring Vanke's shares. By the end of 2015, Baoneng had emerged as Vanke's largest shareholder, and China Evergrande, Vanke's major rival, joined the takeover effort. Together, they aimed to oust Vanke's existing management, including its internationally recognized founder, Wang Shi. However, their efforts were ultimately unsuccessful due to the Chinese government's intervention, which tightened regulations on debt-driven acquisition strategies and transformed the flagship real estate developer into a state-owned entity. The Vanke case ignited a national public discourse about the need for takeover protection in China's stock market (E-House, 2018).

Vanke's decentralized ownership structure made it particularly vulnerable to a takeover bid. Before the struggle for control over Vanke began at the end of 2014, small shareholders owned roughly 60% of the company's shares, while China Resources, the largest shareholder, held a 15% stake. Wang Shi and his executive team held only about 0.2% of the company's shares when Baoneng launched its attack. Vanke had not established any takeover protection measures, including DNEC, in its corporate charter to counter unsolicited suitors, which left the company, along with other Chinese firms in similar circumstances, with few options to prevent an aggressor from increasing its stake. Such a hostile takeover also harms current shareholders, who may face stock price volatility and crash risk due to unstable corporate governance and uncertainty about the firm's future. As a result, "China-style" corporate governance persists, which limits the separation of owners and managers, granting managers the power to direct corporate strategy and block hostile takeovers by virtue of their shareholdings in the company.

Vanke's takeover issue spurred an increasing number of companies to adopt takeover

protection measures by including provisions in their corporate charters. These measures aim to defend against hostile acquisitions by making it more difficult for the acquirer to gain control of the management. However, in 2017, the China Securities Investor Services Center (ISC), which operates under the direct administration of the China Securities Regulatory Commission (CSRC), expressed concern about improper takeover protection provisions and reminded companies that "corporate charter amendments should not exceed the law." The ISC noted that neither China's Securities Law nor Company Law explicitly restricts takeovers or takeover protection. It is reasonable for companies to adopt legal takeover protection in their corporate charters to prevent a hostile takeover, which is in line with the original intention of legislation and regulation established by regulatory bodies. However, listed companies should not exceed legal provisions for the benefit of major shareholders or management, disrupt corporate governance and the good order of the capital market, and cause harm to the interests of listed companies and the legitimate rights and interests of small and medium investors.

The Aishi Case

One contentious case in China is the "takeover protection case of Aishi Company." Aishi Company adopted a DNEC provision in its corporate charter to deter the hostile acquisition bid made by Dagang Oilfield Company. The provision required that only shareholders who met two conditions, namely (1) a specific shareholding ratio and (2) shareholding period requirements, had the right to nominate directors. As this provision was uncommon at the time, the China Securities Regulatory Commission (CSRC) urged Aishi Company to amend its corporate charter as soon as possible following the procedures outlined in the "Company Law." However, as there was no formal judicial guidance on legal interpretation obtained through court proceedings, there remains a dispute over the validity of these two prerequisite conditions for DNEC in China. In the next section, we will discuss these two conditions, namely the share ownership requirement and shareholding period requirement.

8.2.2 Further information about DNEC

The increased merger and acquisition activity in China has led to a rise in the use of DNEC provisions. However, most of these provisions are based on a share ownership threshold, shareholding period, or both. This section discusses the validity of DNEC provisions according to China's legal system, as well as a detailed description of these provisions based on the current real-world scenario.

1. Usage of DNEC and relevant law in China

The right of director nomination refers to the right to recommend candidates for inclusion on the board of directors. This nomination is typically made at the shareholder meeting when the board of directors needs to be replaced or added. As the nomination is a prerequisite for election, the right of director nomination is essential in corporate governance.

However, China's Company Law only stipulates that the shareholders' meeting shall elect directors, and there is no clear regulation on the right of director nomination. Therefore, the director nomination right typically appears in the corporate charters of listed firms, which grant shareholders the right of director nomination. The right to choose managers is a legal right given to shareholders by the Company Law. Listed firms are required to allow shareholders to propose a certain number of nominees to the board. These nominees are treated in the same manner as management's nominees and appear on the proposal of shareholder meeting sent to shareholders for votes.

Regarding the regulatory guidance issued by the China Securities Regulatory Commission (CSRC), Article 82 of the *Guidelines for the Articles of Association of Listed Companies* stipulates that shareholders must submit a list of candidates for directors and supervisors to the general meeting of shareholders through proposals. However, there is no specific legal guideline on the types of shareholders who can nominate directors. Given the lack of specific guidance on director nomination in China's corporate governance, this gap in regulation leaves the nomination procedure's autonomy right to listed firms. To restrict the rights of director nomination, firms vulnerable to takeover threats amend their corporate charters by adding provisions such

as the following.

Example 1: Shareholders can recommend director candidates to the general meeting of shareholders only if they individually or collectively hold more than 3% of the company's total shares with voting rights issued by the company for 180 consecutive trading days.

Example 2: The list of candidates for non-independent directors shall be proposed by the previous board of directors or by shareholders who individually or collectively hold more than 3% of the total voting shares issued by the company for 180 consecutive trading days.

Restricting the rights of directors' nomination is equivalent to restricting the conditions of the nomination subject. The most controversial issue usually relates to higher requirements on the shareholder's shareholding ratio and holding time. For example, the commonly used "limitation of directors' nomination rights" clause mentioned above requires that "shareholders who individually or collectively hold more than 3% of the company's outstanding voting shares for 180 consecutive trading days" are entitled to nomination rights.

In general, two of the most frequent prerequisites for shareholder nomination are (1) a certain shareholding ratio and (2) shareholding period conditions. However, there is still a dispute over the legal validity of these two prerequisites for DNEC in China. These two conditions will be further discussed in the following section.

2. Requirement on shareholding percentage

The recent rise in takeover activity in China has led to increased concern over managers' control of listed firms in the country. As a result, an increasing number of firms in China have implemented more stringent DNEC requirements in order to deter hostile nominations. With these higher thresholds in place, some shareholders who previously qualified for nomination may now be prevented from doing so.

Traditionally, the nomination of directors has been under the control of the incumbent

board of directors and its nominating committee, which evaluate the performance and characteristics of the existing management team and potential board members, consider the challenges and opportunities faced by the corporation, and nominate candidates accordingly. However, this traditional function of the board has recently been challenged by some firms that involve shareholders in the nomination process.

In nowadays corporations, shareholders are allowed to nominate directors since they invest their own funds in acquiring shares and have a financial stake in the company's success. In the context of shareholder nomination, it is standard practice to require a shareholder to have a minimum ownership of no more than 3% in order to make a nomination. This ownership requirement is essential to promote orderly and effective shareholder voting.

The impact of limitations on shareholders' ability to nominate may vary depending on the percentage of shares required for nomination. As there is no upper limit for share ownership requirements in China's Company Law, some listed firms impose a higher minimum percentage than the common practice of 3%. A highly restrictive requirement, such as one that mandates shareholders to obtain at least 25% of outstanding voting shares before nominating directors, makes it extremely challenging for shareholders to nominate their candidates successfully.

Critics argue that even a 5% ownership requirement is too onerous in a shareholder nomination scenario. First, a higher ownership requirement presents an additional obstacle for shareholders to make a simple nomination. With such requirements, very few shareholders may have the requisite number of shares to field an opposing slate. In contrast, the incumbent board's nominees face no such ownership threshold, providing an unreasonable advantage to board-selected candidates. Second, incumbent directors may exploit such high ownership requirements to disenfranchise certain shareholders and gain control of the firm. If implemented, such changes would trigger a surge of proposed nominations from institutional investors in listed firms. Therefore, it is crucial to assess the impact of limiting shareholders' nomination rights in different contexts.

3. Requirement on shareholding period

One type of DNEC that has been utilized is the durational holding requirement, which mandates that a specified minimum level of share ownership be held for a defined period before the shareholder can nominate directors. The justification for such a requirement is that long-term shareholders have a greater interest in the corporation's success and should, therefore, have a greater voice in corporate governance. In fact, provisions in corporate charters prescribing tenure voting and scaling voting rights based on the duration of shareholding have been upheld.

However, opponents argue that the requirement is too burdensome for shareholders, reducing their flexibility and providing only marginal benefits in terms of disseminating additional information on ownership structure. Furthermore, the requirement creates an unfair advantage for board nominees, as it places an undue burden on shareholders' rights to nominate. This burden includes requiring shareholders to submit their nominees months before the board must submit theirs. As such, it is crucial to evaluate the impact of the shareholding period requirement on the nomination process.

Chapter 5 Conclusion and future research

This thesis aims to identify the factors determining ESG reputational risk, general corporate risk, and stock price crash risk using novel data to address data availability issues, applying causal inference to mitigate endogenous issues, and conducting mechanism analysis to explain the economic significance.

1. General corporate risk

The Chapter 2 explores how CEO career concerns mitigate general corporate risks by using similar RDD techniques as in the first part. The results demonstrate that career-concerned CEOs become more risk-averse in the subsequent year than otherwise similar CEOs without such concerns. Further analysis of corporate policies shows that career-concerned CEOs tend to make fewer investments, hold more cash, and pay higher dividends, suggesting that risk-averse CEOs allocate more firm resources to risk-free assets to reduce firm risk. This analysis contributes to the literature on the mechanism of general corporate risk and the unexpected impact of relative incentives. This thesis also establishes an empirical link between job security concerns, the CEO's risk-aversion tendency, and general corporate risk

The findings of this research provide pertinent insights for policymakers and corporate governance structures. They highlight the strong influence of CEO career concerns and the structure of RPE systems on a firm's risk-taking behavior and overall corporate policy. As such, corporations may need to reconsider the nature of their performance evaluation systems, perhaps incorporating long-term risk-taking and sustainability metrics into their CEO assessments. This would mitigate an overly risk-averse strategy and encourage CEOs to engage in value-adding ventures while maintaining a prudent risk management approach. Moreover, regulators might also want to consider these results when framing guidelines on executive remuneration and performance metrics. The fact that career concerns can indirectly lead to more conservative corporate strategies underscores the importance of having a balanced evaluation approach, taking into account both short-term performance and long-term stability and growth.

The valorization of this study is evident in its implications for a wide array of stakeholders, from corporate boards to shareholders and regulators. For corporations, this research offers valuable insights into how performance evaluation systems can shape CEO behavior and, in turn, impact corporate policy and risk management. It could encourage them to revise their evaluation methods to balance short-term performance with long-term firm sustainability. For investors, these findings can provide a better understanding of how CEO career concerns might influence corporate risk-taking behavior, enabling more informed investment decisions. Furthermore, for regulatory bodies, the research serves as an empirical basis for reform discussions around executive compensation and assessment criteria. The study contributes to broader discourses around sustainable corporate governance, CEO assessment, and corporate risk management.

Building on the valuable findings of this research, future studies could delve into several intriguing directions. One intriguing line of inquiry is to investigate how CEO career concerns and resultant risk aversion behavior change with various governance structures, including different board compositions, the presence of institutional investors, or activist shareholders. This may offer additional insights into the nuanced interplay between internal and external governance mechanisms and the risk-taking behavior of CEOs. Additionally, it would be beneficial to extend the investigation across different countries or regions to explore the potential influence of diverse regulatory environments and cultural norms on CEO career concerns and risk-taking behavior. This can help us understand the current findings' generalizability and cross-cultural validity. Finally, a longitudinal examination of CEO career concerns' effect on corporate financial decisions over an extended period could uncover longer-term impacts and potential feedback loops that might not be apparent in a shorter timeframe. Such extended research could provide a richer, more comprehensive picture of the complex relationship between CEO career concerns, corporate risk-taking, and financial performance.

2. ESG reputational risk

The Chapter 3 of this thesis uses RDD to capture an exogenous shock to CEO career concerns and shows how CEO career concerns reduce ESG reputational risk. However,

CEO career concerns worsen overall ESG performances. The findings suggest that career-concerned CEOs prioritize ESG reputational risk management, which produces immediate effects while neglecting actual ESG engagement that requires long-term commitments. This paper contributes to the ESG reputational risk management literature by directly linking it to CEO career concerns. It also contributes to the literature on performance-based contracts by showing that CEOs who miss RPE targets are more likely to manage ESG reputational risk as a hedging tool to compensate for their RPE underperformance.

The outcomes of this study provide critical insights into the potential unforeseen consequences of Relative Performance Evaluation (RPE) schemes and CEO career concerns. It raises a fundamental question regarding the efficiency of these evaluations if they inadvertently encourage CEOs to prioritize immediate ESG reputational risk management over long-term ESG commitments. Consequently, companies might reconsider their RPE schemes' structure and objectives to incentivize immediate and sustained ESG performance. Moreover, the evident disconnect between reputational risk reduction and actual ESG performance improvement has significant implications for regulatory bodies. It stresses the importance of stricter ESG reporting standards to ensure that a decrease in reputational risk is not masking poor ESG performance. More transparent ESG reporting could help to deter reputation management from becoming a smokescreen for insufficient ESG engagement.

The valorization of this study lies in its practical implications for a range of stakeholders, including corporations, investors, regulators, and the public at large. The findings can assist corporations in rethinking their RPE systems to promote more sustainable ESG practices. Investors can leverage these insights to perform more nuanced evaluations of a firm's ESG commitments. Regulators can utilize the evidence presented in this research to tighten ESG reporting requirements, thus promoting greater transparency in corporate sustainability initiatives. Finally, these results can also inform public debate on corporate ESG practices, raising awareness about the potential discrepancies between reputational risk management and actual ESG performance. In this way, the study may facilitate more informed societal pressure on corporations for genuine and sustained ESG engagement. Hence, the research could have a ripple effect, driving change towards more responsible corporate behavior.

Building on the valuable findings of this research, future studies could delve into several intriguing directions. First, one potential approach is to find an alternative instrument that brings serious and continuous career concern to the CEO and then observe its impact in the long term. Another intriguing line of inquiry is investigating how CEO career concerns and resultant risk aversion behavior change with various governance structures, including different board compositions, the presence of institutional investors, or activist shareholders. This may offer additional insights into the nuanced interplay between internal and external governance mechanisms and the risk-taking behavior of CEOs. Additionally, it would be beneficial to extend the investigation across different countries or regions to explore the potential influence of diverse regulatory environments and cultural norms on CEO career concerns and risk-taking behavior. This can help us understand the current findings' generalizability and cross-cultural validity. Finally, a longitudinal examination of CEO career concerns' effect on corporate financial decisions over an extended period could uncover longer-term impacts and potential feedback loops that might not be apparent in a shorter timeframe. Such extended research could provide a richer, more comprehensive picture of the complex relationship between CEO career concerns, corporate risk-taking, and financial performance.

3. Stock price crash risk

The Chapter 4 of this thesis investigates how stock price crash risk is alleviated, using data from thousands of hand-collected Chinese corporate charters. The results show that higher Director Nomination Eligibility Criteria (DNEC) can reduce stock price crash risk and improve information disclosure. This occurs by deterring the nomination of finance-background directors by short-term institutional investors. These investors may adversely intervene in corporate financial reporting opacity for short-term profits. In contrast, higher DNEC could attract directors with a business background and industry expertise, promoting corporate business development. This thesis reveals how DNEC changes stock price crash risk by changing the director board room composition in an asymmetric information environment. This thesis contributes to the stock price crash risk mechanism, empirical evidence of shareholder rights change impact, and the literature on activist institutional investors.

Our findings have profound implications for the design of DNEC and its role in shaping corporate governance structures, especially within the Chinese context. It is evident that robust DNEC is an essential tool for reducing stock price crash risk, primarily by reshaping the boardroom composition and enhancing information disclosure transparency. Thus, corporate boards and regulators should seek to establish stringent DNEC that deter finance-focused directors nominated by short-term institutional investors. These finance-focused directors might induce higher financial reporting opacity and stock price volatility due to their pursuit of short-term gains. Instead, boards should favor candidates with business backgrounds and industry expertise who can foster long-term growth and stability. Furthermore, the policy implications extend to non-state-owned enterprises (Non-SOEs) and firms with more retail investors and volatile stock prices, where the effect of DNEC on reducing stock price crash risk is more significant. Hence, policymakers must consider these factors while framing regulations on DNEC.

The valorization of this study lies in its ability to inform and influence a range of stakeholders, including corporate boards, investors, and regulatory bodies. This research provides empirical evidence for corporate boards that DNEC can play a pivotal role in enhancing boardroom effectiveness, reducing stock price crash risks, and fostering long-term corporate growth. This understanding may help boards design and implement more stringent nomination eligibility criteria. For investors, particularly retail investors, understanding the role of DNEC in risk mitigation could guide investment decision-making, particularly in companies with high stock price volatility. Lastly, regulatory bodies can leverage these insights to revise director nomination guidelines and enforce stricter DNEC to enhance corporate governance, reduce market instability, and protect investor interests. The research thus provides a meaningful contribution to the literature on stock price crash risk, shareholder rights impact, and the role of activist institutional investors in the context of Chinese corporate governance.

While this thesis has made significant strides in exploring the relationship between Director Nomination Eligibility Criteria (DNEC) and stock price crash risk within the context of China's unique corporate governance landscape, it also opens up avenues for further investigation. First, further research could investigate whether career concerns

or DNEC affect other potential or hidden corporate risks. The use of alternative data to measure unobservable corporate risks could be a means of exploring what factors determine these hidden risks. One potential approach is to replace the original corporate risk indicators with the predicted counterfactual corporate risk via advanced out-of-sample prediction techniques. Second, an area ripe for exploration is extending the geographical scope of the study to a global context, comparing and contrasting how DNEC influences corporate risk in countries with different governance structures, market dynamics, and regulatory environments. This comparison would provide a broader understanding of DNEC's influence on risk management and the potential for regulatory convergence or divergence. Furthermore, it would be intriguing to dive deeper into how implementing DNEC could impact the behavior of different types of investors and reshape corporate governance across industries and countries. Lastly, the role of digital technology in shaping corporate transparency and risk could be examined, specifically investigating how DNEC interacts with modern reporting tools to influence corporate transparency and the associated implications for stock price crash risk.

Reference

Admati, A.R., Pfleiderer, P., 2009. The "Wall Street Walk" and shareholder activism: Exit as a form of voice. The Review of Financial Studies 22, 2645–2685. https://doi.org/10.1093/rfs/hhp037

Ahmed, A.S., Duellman, S., 2013. Managerial overconfidence and accounting conservatism. Journal of accounting research 51, 1–30. https://doi.org/10.1111/j.1475-679X.2012.00467.x

Allen, F., Qian, J., Qian, M., 2005. Law, finance, and economic growth in China. Journal of Financial Economics 77, 57–116. https://doi.org/10/bsd8kr

Almeida, H., Campello, M., Weisbach, M.S., 2004. The cash flow sensitivity of cash. The journal of finance 59, 1777–1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x

Amihud, Y., Lev, B., 1981. Risk reduction as a managerial motive for conglomerate mergers. The bell journal of economics 605–617. https://doi.org/10.2307/3003575

An, H., Zhang, T., 2013. Stock price synchronicity, crash risk, and institutional investors. Journal of Corporate Finance 21, 1–15. https://doi.org/10.1016/j.jcorpfin.2013.01.001

Asante-Appiah, B., Lambert, T.A., 2022. The role of the external auditor in managing environmental, social, and governance (ESG) reputation risk. Review of Accounting Studies 1–53.

Bai, C., Liu, Q., Lu, Z., Song, M., Zhang, J., 2005. An empirical study on Chinese listed firms' corporate governance. Economic Research Journal 2, 81–91.

Bainbridge, S.M., 2006. Director primacy and shareholder disempowerment. Harvard Law Review 119, 1735–1758.

Bargeron, L.L., Lehn, K.M., Zutter, C.J., 2010. Sarbanes-Oxley and corporate risk-taking. Journal of Accounting and Economics 19. https://doi.org/10.1016/j.jacceco.2009.05.001

Baron, R.M., Kenny, D.A., 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology 51, 1173.

Basil, D.Z., Weber, D., 2006. Values motivation and concern for appearances: the effect of personality traits on responses to corporate social responsibility. International Journal of Nonprofit and Voluntary Sector Marketing 11, 61–72. https://doi.org/10.1002/nvsm.38

Bebchuk, L.A., 2004. The case for increasing shareholder power. Harv. L. Rev. 118, 833.

Bebchuk, L.A., Brav, A., Jiang, W., 2015. The Long-Term Effects of Hedge Fund Activism. https://doi.org/10.2139/ssrn.2291577

Bénabou, R., Tirole, J., 2010. Individual and corporate social responsibility. Economica 77, 1–19. https://doi.org/10.1111/j.1468-0335.2009.00843.x

Bennett, B., Bettis, J.C., Gopalan, R., Milbourn, T., 2017. Compensation goals and firm performance. Journal of Financial Economics 124, 307–330. https://doi.org/10.1016/j.jfineco.2017.01.010

Bertrand, M., Mullainathan, S., 2001. Are CEOs rewarded for luck? The ones without principals are. The Quarterly Journal of Economics 116, 901–932. https://doi.org/10.1162/00335530152466269

Bettis, C., Bizjak, J., Coles, J., Kalpathy, S., 2010. Stock and Option Grants with

Performance-based Vesting Provisions. Rev. Financ. Stud. 23, 3849–3888. https://doi.org/10.1093/rfs/hhq060
Bettis, J.C., Bizjak, J., Coles, J.L., Kalpathy, S., 2018. Performance-vesting provisions in executive compensation. Journal of Accounting and Economics 66, 194–221. https://doi.org/10.1016/j.jacceco.2018.05.001
Black, B.S., 1997. Shareholder Activism and Corporate Governance in the United States. https://doi.org/10.2139/ssrn.45100
Bolton, P., Mehran, H., Shapiro, J., 2015. Executive Compensation and Risk Taking. Review of Finance 19, 2139–2181. https://doi.org/10.1093/rof/rfu049
Boubakri, N., Cosset, J.C., Saffar, W., 2013. The role of state and foreign owners in corporate risk-taking: Evidence from privatization. Journal of Financial Economics 108, 641–658. https://doi.org/10.1016/j.jfineco.2012.12.007
Bratton, W.W., Wachter, M.L., 2010. The case against shareholder empowerment. University of Pennsylvania Law Review 653–728.
Brav, A., Graham, J.R., Harvey, C.R., Michaely, R., 2005. Payout policy in the 21st century. Journal of financial economics 77, 483–527. https://doi.org/10.1016/j.jfineco.2004.07.004
Brav, A., Jiang, W., Kim, H., 2015. Recent advances in research on hedge fund activism: Value creation and identification. https://doi.org/10.1146/annurev-financial-111914-041751
Brickley, J.A., Linck, J.S., Coles, J.L., 1999. What happens to CEOs after they retire? New evidence on career concerns, horizon problems, and CEO incentives. Journal of Financial Economics 52, 341–377. https://doi.org/10.1016/S0304-405X(99)00012-4
Bushee, B.J., 2001. Do institutional investors prefer near-term earnings over long-run value? Contemporary accounting research 18, 207–246. https://doi.org/10.1506/J4GU-BHWH-8HME-LE0X
Butler, A.A., 2017. Shareholder Nomination Restrictions: A Corporate Governance Mystery. Mo. L. Rev. 82, 1141.
Caliskan, D., Doukas, J.A., 2015. CEO risk preferences and dividend policy decisions. Journal of Corporate Finance 35, 18–42. https://doi.org/10.1016/j.jcorpfin.2015.08.007
Callen, J.L., Fang, X., 2015. Short interest and stock price crash risk. Journal of Banking and Finance 60, 181–194. https://doi.org/10.1016/j.jbankfin.2015.08.009
Callen, J.L., Fang, X., 2013. Institutional investor stability and crash risk: Monitoring versus short-termism? Journal of Banking and Finance 37, 3047–3063. https://doi.org/10.1016/j.jbankfin.2013.02.018
Calonico, S., Cattaneo, M.D., Titiunik, R., 2014. Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs. Econometrica 82, 2295–2326. https://doi.org/10.3982/ecta11757
Campbell, J.T., Campbell, T.C., Sirmon, D.G., Bierman, L., Tuggle, C.S., 2012. Shareholder influence over director nomination via proxy access: Implications for agency conflict and stakeholder value. Strat. Mgmt. J. 33, 1431–1451. https://doi.org/10.1002/smj.1989
Campbell, J.Y., Hilscher, J., Szilagyi, J., 2008. In Search of Distress Risk. The Journal of Finance 63, 2899–2939. https://doi.org/10.1111/j.1540-6261.2008.01416.x
Cao, J., Liang, H., Zhan, X., 2019. Peer Effects of Corporate Social Responsibility. Management Science mnsc.2018.3100. https://doi.org/10.1287/mnsc.2018.3100

Capelle-Blancard, G., Petit, A., 2019. Every little helps? ESG news and stock market reaction. Journal of Business Ethics 157, 543–565. https://doi.org/10.1007/s10551-017-3667-3
Capezio, A., Shields, J., O'Donnell, M., 2011. Too good to be true: board structural independence as a moderator of CEO pay-for-firm-performance. Journal of Management Studies 48, 487–513. https://doi.org/10.1111/j.1467-6486.2009.00895.x
Carpenter, J.N., 2000. Does option compensation increase managerial risk appetite? The journal of finance 55, 2311–2331. https://doi.org/10.1111/0022-1082.00288
Cassell, C.A., Huang, S.X., Sanchez, J.M., Stuart, M.D., 2012. Seeking safety: The relation between CEO inside debt holdings and the riskiness of firm investment and financial policies. Journal of Financial Economics 103, 588–610. https://doi.org/10.1016/j.jfineco.2011.10.008
Chang, Y.Y., Dasgupta, S., Hilary, G., 2010. CEO Ability, Pay, and Firm Performance. Management Science 56, 1633–1652. https://doi.org/10.1287/mnsc.1100.1205
Chen, C.R., Steiner, T.L., Whyte, A.M., 2006. Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. Journal of Banking and Finance 30, 915–945. https://doi.org/10/b2ftqf
Chen, J., Ezzamel, M., Cai, Z., 2011. Managerial power theory, tournament theory, and executive pay in China. Journal of Corporate Finance 17, 1176–1199. https://doi.org/10.1016/j.jcorpfin.2011.04.008
Chen, J., Hong, H., Stein, J.C., 2001. Forecasting crashes: Trading volume, past returns, and conditional skewness in stock prices. Journal of Financial Economics 61, 345–381. https://doi.org/10.1016/S0304-405X(01)00066-6
Chen, J.J., Liu, X., Li, W., 2010. The effect of insider control and global benchmarks on Chinese executive compensation. Corporate Governance: An International Review 18, 107–123. https://doi.org/10.1111/j.1467-8683.2010.00788.x
Chen, K.C., Chen, Z., Wei, K.J., 2011. Agency costs of free cash flow and the effect of shareholder rights on the implied cost of equity capital. Journal of financial and quantitative analysis 46, 171–207. https://doi.org/10.1017/S0022109010000591
Chen, Z., Ke, B., Yang, Z., 2013. Minority shareholders' control rights and the quality of corporate decisions in weak investor protection countries: A natural experiment from China. The Accounting Review 88, 1211–1238. https://doi.org/10.2308/accr-50424
Cheng, B., Ioannou, I., Serafeim, G., 2014. Corporate social responsibility and access to finance. Strategic management journal 35, 1–23. https://doi.org/10.1002/smj.2131
Cheung, A., Hu, M., Schwiebert, J., 2018. Corporate social responsibility and dividend policy. Accounting & Finance 58, 787–816. https://doi.org/10.1111/acfi.12238
Chevalier, J., Ellison, G., 1999. Career concerns of mutual fund managers. The Quarterly Journal of Economics 114, 389–432. https://doi.org/10.1162/003355399556034
Cho, C.H., Laine, M., Roberts, R.W., Rodrigue, M., 2015. Organized hypocrisy, organizational façades, and sustainability reporting. Accounting, organizations and society 40, 78–94. https://doi.org/10.1016/j.aos.2014.12.003
Choi, D., Gao, Z., Jiang, W., 2020. Attention to global warming. The Review of Financial Studies 33, 1112–1145. https://doi.org/10.1093/rfs/hhz086
Chu, Y., Deng, S., Peng, Y., Xia4, C., 2021. Not My Fault Missing the Target and CEO's

Self-Attribution Bias. Working Paper.
Coffee Jr, J.C., Palia, D., 2016. The wolf at the door: The impact of hedge fund activism on corporate governance. Annals of Corporate Governance 1, 1–94. https://doi.org/10.1561/109.00000003
Cohen, J., Holder-Webb, L., Nath, L., Wood, D., 2011. Retail investors' perceptions of the decision-usefulness of economic performance, governance, and corporate social responsibility disclosures. Behavioral Research in Accounting 23, 109–129. https://doi.org/10.2308/bria.2011.23.1.109
Cohn, J.B., Gillan, S.L., Hartzell, J.C., 2016. On Enhancing Shareholder Control: A (Dodd-) Frank Assessment of Proxy Access. Journal of Finance 71, 1623–1668. https://doi.org/10.1111/jofi.12402
Cole, S., Kanz, M., Klapper, L., 2015. Incentivizing calculated risk-taking: Evidence from an experiment with commercial bank loan officers. The Journal of Finance 70, 537–575. https://doi.org/10.1111/jofi.12233
Coles, J.L., Daniel, N.D., Naveen, L., 2006. Managerial incentives and risk-taking. Journal of Financial Economics 79, 431–468. https://doi.org/10.1016/j.jfineco.2004.09.004
Connelly, B.L., Hoskisson, R.E., Tihanyi, L., Certo, S.T., 2010. Ownership as a form of corporate governance. Journal of management studies 47, 1561–1589. https://doi.org/10.1111/j.1467-6486.2010.00929.x
Conrad, J., Dittmar, R.F., Ghysels, E., 2013. Ex Ante Skewness and Expected Stock Returns. Journal of Finance 68, 85–124. https://doi.org/10.1111/j.1540-6261.2012.01795.x
Cremers, M., Ferrell, A., 2014. Thirty years of shareholder rights and firm value. The Journal of Finance 69, 1167–1196. https://doi.org/10.1111/jofi.12138
Cziraki, P., Groen-Xu, M., 2020. CEO Turnover and Volatility under Long-Term Employment Contracts. J. Financ. Quant. Anal. 55, 1757–1791. https://doi.org/10.1017/S0022109019000632
Cziraki, P., Groen-Xu, M., 2014. CEO career concerns and risk taking. Revolution.
Cziraki, P., Jenter, D., 2020. The Market for CEOs (SSRN Scholarly Paper No. 3644496). Social Science Research Network, Rochester, NY. https://doi.org/10.2139/ssrn.3644496
Datta, S., Iskandar-Datta, M., Singh, V., 2013. Product market power, industry structure, and corporate earnings management. Journal of Banking & Finance 37, 3273–3285. https://doi.org/10.1016/j.jbankfin.2013.03.012
DeAngelo, H., DeAngelo, L., Skinner, D.J., 2009. Corporate payout policy. Foundations and Trends® in Finance 3, 95–287. https://doi.org/10.1561/0500000020
DeAngelo, H., DeAngelo, L., Stulz, R.M., 2006. Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory. Journal of Financial economics 81, 227–254. https://doi.org/10.1016/j.jfineco.2005.07.005
Dechow, P.M., Sloan, R.G., 1991. Executive incentives and the horizon problem: An empirical investigation. Journal of accounting and Economics 14, 51–89. https://doi.org/10.1016/0167-7187(91)90058-S
Dechow, P.M., Sloan, R.G., Sweeney, A.P., Sloan, R.G., 2015. Detecting Earnings Management. Asian Financial Statement Analysis 70, 73–105. https://doi.org/10.1002/9781119204763.ch4
Delmas, M.A., Burbano, V.C., 2011. The drivers of greenwashing. California management review 54, 64–87. https://doi.org/10.1525/cmr.2011.54.1.64

Demers, E., Hendrikse, J., Joos, P., Lev, B., 2021. ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. J Bus Fin Acc 48, 433–462. https://doi.org/10.1111/jbfa.12523
Derrien, F., Kecskés, A., Thesmar, D., 2013. Investor horizons and corporate policies. Journal of Financial and Quantitative Analysis 48, 1755–1780. https://doi.org/10.1017/S0022109013000628
Derrien, F., Krueger, P., Landier, A., Yao, T., 2022. ESG News, Future Cash Flows, and Firm Value. https://doi.org/10.2139/ssrn.3903274
Dimson, E., 1979. Risk measurement when shares are subject to infrequent trading. Journal of financial economics 7, 197–226. https://doi.org/10.1016/0304-405X(79)90013-8
Dittmar, A., Duchin, R., 2016. Looking in the rearview mirror: The effect of managers' professional experience on corporate financial policy. The Review of Financial Studies 29, 565–602.
Dittmar, A., Mahrt-Smith, J., 2007. Corporate governance and the value of cash holdings. Journal of financial economics 83, 599–634. https://doi.org/10.1016/j.jfineco.2005.12.006
Do, T., Zhang, H., Zuo, L., 2021. Rocking the boat: How relative performance evaluation affects corporate risk taking. Journal of Accounting and Economics 101425. https://doi.org/10.1016/j.jacceco.2021.101425
Donnelly, R., Mulcahy, M., 2008. Board structure, ownership, and voluntary disclosure in Ireland. Corporate Governance: An International Review 16, 416–429. https://doi.org/10.1111/j.1467-8683.2008.00692.x
Easterbrook, F.H., 1984. Two agency-cost explanations of dividends. The American economic review 74, 650–659.
Edmans, A., 2014. Blockholders and corporate governance. Annu. Rev. Financ. Econ. 6, 23–50. https://doi.org/10.1146/annurev-financial-110613-034455
E-House, 2018. Vanke: Fending Off a Hostile Takeover. Report.
Faccio, M., Marchica, M.-T., Mura, R., 2016. CEO gender, corporate risk-taking, and the efficiency of capital allocation. Journal of Corporate Finance 17. https://doi.org/10.1016/j.jcorpfin.2016.02.008
Faleye, O., 2007. Classified boards, firm value, and managerial entrenchment. Journal of Financial Economics 83, 501–529. https://doi.org/10.1016/j.jfineco.2006.01.005
Fama, E.F., 1980. Agency problems and the theory of the firm. Journal of political economy 88, 288–307. https://doi.org/10.1086/260866
Fama, E.F., Jensen, M.C., 1983. Separation of ownership and control. The journal of law and Economics 26, 301–325. https://doi.org/10.1086/467037
Firth, M., Gao, J., Shen, J., Zhang, Y., 2016. Institutional stock ownership and firms' cash dividend policies: Evidence from China. Journal of Banking & Finance 65, 91–107. https://doi.org/10.1016/j.jbankfin.2016.01.009
Foley, C.F., Hartzell, J.C., Titman, S., Twite, G., 2007. Why do firms hold so much cash? A tax-based explanation. Journal of financial economics 86, 579–607. https://doi.org/10.1016/j.jfineco.2006.11.006
Friedman, H.L., Heinle, M.S., 2016. Taste, information, and asset prices: Implications for the valuation of CSR. Review of Accounting Studies 21, 740–767. https://doi.org/10.1007/s11142-016-9359-x
Frydman, C., Jenter, D., 2010. CEO compensation. NBER Working Paper. https://doi.org/10.3386/w16585
Gao, M., 2019. Get the Money Somehow The Effect of Missing Performance Goals on

Insider Trading. SSRN Electronic Journal. https://doi.org/10/gjfvxj
Gaspar, J.-M., Massa, M., Matos, P., 2005. Shareholder investment horizons and the market for corporate control. Journal of financial economics 76, 135–165. https://doi.org/10.1016/j.jfineco.2004.10.002
Gibbons, R., Murphy, K.J., 1992. Optimal incentive contracts in the presence of career concerns: Theory and evidence. Journal of political Economy 100, 468–505. https://doi.org/10.1086/261826
Gibbons, R., Murphy, K.J., 1990. Relative Performance Evaluation for Chief Executive Officers. Industrial and Labor Relations Review 43, 30S. https://doi.org/10.2307/2523570
Gillan, S., Starks, L.T., 2003. Corporate governance, corporate ownership, and the role of institutional investors: A global perspective. Weinberg Center for Corporate Governance Working Paper.
Gillan, S.L., Starks, L.T., 2000. Corporate governance proposals and shareholder activism: the role of institutional investors. Journal of Financial Economics 57 57.
Giroud, X., Mueller, H.M., 2010. Does corporate governance matter in competitive industries? Journal of financial economics 95, 312–331. https://doi.org/10.1016/j.jfineco.2009.10.008
Godfrey, P.C., Merrill, C.B., Hansen, J.M., 2009. The relationship between corporate social responsibility and shareholder value: an empirical test of the risk management hypothesis. Strat. Mgmt. J. 30, 425–445. https://doi.org/10.1002/smj.750
Gompers, P., Ishii, J., Metrick, A., 2003. Corporate Governance and Equity Prices. The Quarterly Journal of Economics 118, 107–156.
Gonçalves, A.S., 2021. Reinvestment Risk and the Equity Term Structure. The Journal of Finance 76, 2153–2197. https://doi.org/10.1111/jofi.13035
Gong, G., Li, L.Y., Yin, H., 2019a. Relative performance evaluation and the timing of earnings release. Journal of Accounting and Economics 67, 358–386. https://doi.org/10.1016/j.jacceco.2019.03.002
Gong, G., Li, L.Y., Yin, H., 2019b. Relative performance evaluation and the timing of earnings release. Journal of Accounting and Economics 67, 358–386. https://doi.org/10.1016/j.jacceco.2019.03.002
Gormley, T.A., Matsa, D.A., 2016. Playing it safe? Managerial preferences, risk, and agency conflicts. Journal of financial economics 122, 431–455. https://doi.org/10.1016/j.jfineco.2016.08.002
Graham, J.R., Harvey, C.R., Rajgopal, S., 2005. The economic implications of corporate financial reporting. Journal of accounting and economics 40, 3–73. https://doi.org/10.1016/j.jacceco.2005.01.002
Grullon, G., Michaely, R., Swaminathan, B., 2002. Are dividend changes a sign of firm maturity? The journal of Business 75, 387–424. https://doi.org/10.1086/339889
Gulamhussen, M.A., Pinheiro, C., Sousa, R., 2012. The Influence of Managerial Ownership on Bank Market Value, Performance, and Risk: Evidence from Banks Listed on the Stoxx Global Index. J Int Financ Manage Account 23, 121–153. https://doi.org/10.1111/j.1467-646X.2012.01056.x
Hambrick, D.C., Fukutomi, G.D., 1991. The seasons of a CEO's tenure. Academy of management review 16, 719–742. https://doi.org/10.2307/258978
Hamdani, A., Yafeh, Y., 2013. Institutional investors as minority shareholders. Review of Finance 17, 691–725. https://doi.org/10.1093/rof/rfr039
Hamermesh, L.A., 2014. Director Nominations. Del. J. Corp. L. 39, 117.

Han, S., Qiu, J., 2007. Corporate precautionary cash holdings. Journal of corporate finance 13, 43–57. https://doi.org/10.1016/j.jcorpfin.2006.05.002
Harford, J., Mansi, S.A., Maxwell, W.F., 2008. Corporate governance and firm cash holdings in the US. Journal of financial economics 87, 535–555. https://doi.org/10.1016/j.jfineco.2007.04.002
Harvey, C.R., Siddique, A., 2000. Conditional skewness in asset pricing tests. Journal of Finance 55, 1263–1295. https://doi.org/10.1111/0022-1082.00247
Heckman, J., 1979. Sample Specification Bias as a Selection Error. Econometrica.
Hermalin, B.E., 1993. Managerial preferences concerning risky projects. JL Econ. & Org. 9, 127.
Hirshleifer, D., Thakor, A., 1992. Managerial Conservatism, Project Choice,and Debt. Tbe Review of Financial Studies 5.
Holmstrom, B., 1999. Managerial Incentive Problems: A Dynamic Perspective. Rev Econ Studies 66, 169–182. https://doi.org/10.1111/1467-937X.00083
Holmstrom, B., 1982. Moral Hazard in Teams. The Bell Journal of Economics 13, 324. https://doi.org/10.2307/3003457
Holmstrom, B., Costa, J.R.I., 1986. Managerial incentives and capital management. The Quarterly Journal of Economics 101, 835–860. https://doi.org/10.2307/1884180
Hong, Z., Chang, Z., Wanfa, L., Guoping, L., 2018. Corporate Governance and Credit Spreads on Corporate Bonds: An Empirical Study of China's Corporate Bonds from 2008 to 2016. Accounting Research 59–66.
Hummel, K., Schlick, C., 2016. The relationship between sustainability performance and sustainability disclosure–Reconciling voluntary disclosure theory and legitimacy theory. Journal of accounting and public policy 35, 455–476. https://doi.org/10.1016/j.jaccpubpol.2016.06.001
Hutton, A.P., Marcus, A.J., Tehranian, H., 2009a. Opaque financial reports, R2, and crash risk. Journal of Financial Economics 94, 67–86. https://doi.org/10.1016/j.jfineco.2008.10.003
Hutton, A.P., Marcus, A.J., Tehranian, H., 2009b. Opaque financial reports, R2, and crash risk. Journal of Financial Economics 94, 67–86. https://doi.org/10.1016/j.jfineco.2008.10.003
Imbens, G., Kalyanaraman, K., 2012. Optimal Bandwidth Choice for the Regression Discontinuity Estimator. The Review of Economic Studies 79, 933–959. https://doi.org/10.1093/restud/rdr043
Imbens, G.W., Lemieux, T., 2008. Regression discontinuity designs: A guide to practice. Journal of Econometrics 142, 615–635. https://doi.org/10.1016/j.jeconom.2007.05.001
Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. The American economic review 76, 323–329.
Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3, 305–360. https://doi.org/10.1016/0304-405X(76)90026-X
Jensen, M.C., Ruback, R.S., 2015. The Market for Corporate Control. Journal of Financial Economics 11, 50–60. https://doi.org/10.1057/9781137451743_8
Jensen, M.C., Warner, J.B., 1988. The distribution of power among corporate managers, shareholders, and directors. Journal of Financial Economics 20, 3–24. https://doi.org/10.1016/0304-405X(88)90038-4
Jenter, D., Kanaan, F., 2015. CEO Turnover and Relative Performance Evaluation. The Journal of Finance 70, 2155–2184. https://doi.org/10.1111/jofi.12282

Jenter, D., Lewellen, K., 2015. CEO preferences and acquisitions. The Journal of Finance 70, 2813–2852. https://doi.org/10.1111/jofi.12283
Jiang, F., Kim, K.A., 2015. Corporate governance in China: A modern perspective. Journal of Corporate Finance.
Jiang, G., Lee, C.M.C., Yue, H., 2010. Tunneling through intercorporate loans: The China experience. Journal of Financial Economics 98, 1–20. https://doi.org/10.1016/j.jfineco.2010.05.002
Jin, L., Myers, S.C., 2006a. R2 around the world: New theory and new tests. Journal of Financial Economics 79, 257–292. https://doi.org/10.1016/j.jfineco.2004.11.003
Jin, L., Myers, S.C., 2006b. R2 around the world: New theory and new tests. Journal of Financial Economics 79, 257–292. https://doi.org/10.1016/j.jfineco.2004.11.003
Jiraporn, P., Kim, Y.S., Davidson, W.N., 2005. CEO compensation, shareholder rights, and corporate governance: An empirical investigation. J Econ Finan 29, 242–258. https://doi.org/10.1007/BF02761556
John, K., Litov, L., Yeung, B., 2008. Corporate governance and risk-taking. The Journal of Finance 63, 1679–1728.
Karen, W., YiLin, W., 2021. Relative versus Absolute Performance Evaluation and CEO Decision-Making. SSRN Electronic Journal.
Kennedy, D., Stiglitz, J.E., 2013. Law and economics with Chinese characteristics: Institutions for promoting development in the Twenty-First Century. OUP Oxford.
Khanna, T., Palepu, K.G., Srinivasan, S., 2004. Disclosure practices of foreign companies interacting with US markets. Journal of accounting research 42, 475–508. https://doi.org/10.1111/j.1475-679X.2004.00146.x
Kim, J.B., Li, Y., Zhang, L., 2011a. Corporate tax avoidance and stock price crash risk: Firm-level analysis. Journal of Financial Economics 100, 639–662. https://doi.org/10.1016/j.jfineco.2010.07.007
Kim, J.B., Li, Y., Zhang, L., 2011b. CFOs versus CEOs: Equity incentives and crashes. Journal of Financial Economics 101, 713–730. https://doi.org/10.1016/j.jfineco.2011.03.013
Kim, J.B., Zhang, L., 2016. Accounting Conservatism and Stock Price Crash Risk: Firm-level Evidence. Contemporary Accounting Research 33, 412–441. https://doi.org/10.1111/1911-3846.12112
Kim, J.B., Zhang, L., 2014. Financial reporting opacity and expected crash risk: Evidence from implied volatility smirks. Contemporary Accounting Research 31, 851–875. https://doi.org/10.1111/1911-3846.12048
Kölbel, J.F., Busch, T., Jancso, L.M., 2017. How media coverage of corporate social irresponsibility increases financial risk. Strategic Management Journal 38, 2266–2284. https://doi.org/10.1002/smj.2647
Kothari, S.P., Shu, S., Wysocki, P.D., 2009. Do managers withhold bad news. Journal of Accounting Research 47, 241–276. https://doi.org/10.1111/j.1475-679X.2008.00318.x
Krueger, P., Sautner, Z., Starks, L.T., 2020. The importance of climate risks for institutional investors. The Review of Financial Studies 33, 1067–1111. https://doi.org/10.1093/rfs/hhz137
Krüger, P., 2015. Corporate goodness and shareholder wealth. Journal of Financial Economics 115, 304–329. https://doi.org/10.1016/j.jfineco.2014.09.008
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 2002. Investor protection

and corporate valuation. The journal of finance 57, 1147–1170. https://doi.org/10.1111/1540-6261.00457
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 2000. Investor protection and corporate governance. Journal of financial economics 58, 3–27. https://doi.org/10.1016/S0304-405X(00)00065-9
Laverty, K.J., 2004. Managerial myopia or systemic short-termism? The importance of managerial systems in valuing the long term. Management Decision 42, 949–962. https://doi.org/10.1108/00251740410555443
Li, K., Grif, D., Yue, H., Zhao, L., 2013. How does culture influence corporate risk-taking? Journal of Corporate Finance 23, 1–22. https://doi.org/10.1016/j.jcorpfin.2013.07.008
Li, Xiaoyang, Low, A., Makhija, A.K., 2017. Career concerns and the busy life of the young CEO. Journal of Corporate Finance 47, 88–109. https://doi.org/10.1016/j.jcorpfin.2017.09.006
Li, Xiaorong, Wang, S.S., Wang, X., 2017. Trust and stock price crash risk: Evidence from China. Journal of Banking & Finance 76, 74–91. https://doi.org/10.1016/j.jbankfin.2016.12.003
Lins, K.V., Servaes, H., Tamayo, A., 2017. Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis. The Journal of Finance 72, 1785–1824. https://doi.org/10.1111/jofi.12505
Low, A., 2009. Managerial risk-taking behavior and equity-based compensation. Journal of Financial Economics 92, 470–490.
Lyon, T.P., Montgomery, A.W., 2015. The means and end of greenwash. Organization & Environment 28, 223–249. https://doi.org/10.1177/1086026615575332
Malmendier, U., Shanthikumar, D., 2007. Are small investors naive about incentives? Journal of Financial Economics 85, 457–489. https://doi.org/10.1016/j.jfineco.2007.02.001
Marquis, C., Toffel, M.W., Zhou, Y., 2016. Scrutiny, norms, and selective disclosure: A global study of greenwashing. Organization Science 27, 483–504. https://doi.org/10.1287/orsc.2015.1039
Martin, M.A., Timmermans, O., 2021. Incentive Contracts and Corporate Disclosure: Evidence from Relative Performance Evaluation. CGN: Disclosure & Accounting Decisions (Topic). https://doi.org/10.2139/ssrn.3780997
Masulis, R.W., Mobbs, S., 2014. Independent director incentives: Where do talented directors spend their limited time and energy? Journal of financial economics 111, 406–429. https://doi.org/10.1016/j.jfineco.2013.10.011
Masulis, R.W., Reza, S.W., 2015. Agency problems of corporate philanthropy. The Review of Financial Studies 28, 592–636. https://doi.org/10.1093/rfs/hhu082
Matsumura, E.M., Prakash, R., Vera-Munoz, S.C., 2014. Firm-value effects of carbon emissions and carbon disclosures. The accounting review 89, 695–724. https://doi.org/10.2308/accr-50629
McCrary, J., 2008. Manipulation of the running variable in the regression discontinuity design: A density test. Journal of Econometrics 142, 698–714. https://doi.org/10.1016/j.jeconom.2007.05.005
Mei, J., Scheinkman, J.A., Xiong, W., 2005. Speculative trading and stock prices: Evidence from Chinese AB share premia.
Mikkelson, W.H., Partch, M.M., 2003. Do persistent large cash reserves hinder performance? Journal of financial and quantitative analysis 38, 275–294. https://doi.org/10.2307/4126751
Mizik, N., 2010. The theory and practice of myopic management. Journal of Marketing

Research 47, 594–611. https://doi.org/10.1509/jmkr.47.4.594
Moody's Analytics, 2022. Moody's Analytics: Stronger ESG Risk Mitigation Practices Linked to Better Shareholder Returns [WWW Document]. URL https://www.businesswire.com/news/home/20220622005220/en/Moody%E2%80%99s-Analytics-Stronger-ESG-Risk-Mitigation-Practices-Linked-to-Better-Shareholder-Returns (accessed 11.18.22).
Morck, R., Shleifer, A., Vishny, R.W., 1990. Do Managerial Objectives Drive Bad Acquisitions? The Journal of Finance 45, 31–48.
Murphy, K.J., 2000. Performance standards in incentive contracts. Journal of Accounting and Economics 30, 245–278. https://doi.org/10.1016/S0165-4101(01)00013-1
Narayanan, M., 1985. Managerial incentives for short-term results. The Journal of Finance 40, 1469–1484. https://doi.org/10.1111/j.1540-6261.1985.tb02395.x
NAVEX, 2022. ESG Global Survey Shows that it is a Growing Priority for Businesses [WWW Document]. URL https://www.navex.com/en-us/company/press-room/esg-global-survey-validates-that-esg-is-a-growing-priority-for-businesses/ (accessed 11.18.22).
Ng, J., Tuna, I., Verdi, R., 2013. Management forecast credibility and underreaction to news. Review of Accounting Studies 18, 956–986. https://doi.org/10.1007/s11142-012-9217-4
Opler, T., Pinkowitz, L., Stulz, R., Williamson, R., 1999. The determinants and implications of corporate cash holdings. Journal of financial economics 52, 3–46. https://doi.org/10.1016/S0304-405X(99)00003-3
Otchere, I., Senbet, L.W., Zhu, P., 2020. Does political connection distort competition and encourage corporate risk taking? International evidence. Journal of Empirical Finance 55, 21–42. https://doi.org/10.1016/j.jempfin.2019.10.006
Palepu, K.G., 1986. Predicting takeover targets. A methodological and empirical analysis. Journal of Accounting and Economics 8, 3–35. https://doi.org/10.1016/0165-4101(86)90008-X
Peng, W.Q., Wei, K.J., Yang, Z., 2011. Tunneling or propping: Evidence from connected transactions in China. Journal of Corporate Finance 17, 306–325. https://doi.org/10.1016/j.jcorpfin.2010.08.002
Peters, F.S., Wagner, A.F., 2014. The executive turnover risk premium. The Journal of Finance 69, 1529–1563. https://doi.org/10.1111/jofi.12166
Pozen, R.C., 2018. The Role of Institutional Investors in Curbing Corporate Short-Termism. Financial Analysts Journal. https://doi.org/10.2469/faj.v71.n5.5
Rajgopal, S., Shevlin, T., 2002. Empirical evidence on the relation between stock option compensation and risk taking. Journal of accounting and economics 33, 145–171. https://doi.org/10.1016/S0165-4101(02)00042-3
REFINITIV, 2021. Environmental, social and governance (esg) scores from refinitiv.
Ross, S.A., 2004. Compensation, incentives, and the duality of risk aversion and riskiness. The Journal of Finance 59, 207–225. https://doi.org/10.1111/j.1540-6261.2004.00631.x
SEC, 2010. SEC Adopts New Measures to Facilitate Director Nominations by Shareholders; 2010-155; Aug. 25, 2010 [WWW Document]. URL https://www.sec.gov/news/press/2010/2010-155.htm (accessed 10.31.22).
Shleifer, A., Vishny, R.W., 1997a. A survey of corporate governance. The journal of finance 52, 737–783. https://doi.org/10.1111/j.1540-6261.1997.tb04820.x
Shleifer, A., Vishny, R.W., 1997b. A survey of corporate governance. Journal of Finance LII, n. 2, 737–783. https://doi.org/10.1111/j.1540-6261.1997.tb04820.x

Shleifer, A., Vishny, R.W., 1986. Large shareholders and corporate control. Journal of political economy 94, 461–488. https://doi.org/10.1086/261385
Simon, F.L., 1995. Global corporate philanthropy: a strategic framework. International Marketing Review 12, 20–37. https://doi.org/10.1108/02651339510097711
Singh, M., Davidson III, W.N., 2003. Agency costs, ownership structure and corporate governance mechanisms. Journal of banking & finance 27, 793–816. https://doi.org/10.1016/S0378-4266(01)00260-6
Song, F., Thakor, A.V., 2006. Information Control, Career Concerns, and Corporate Governance. The Journal of Finance 52.
Squire, K., 2013. A Golden Age for Activist Investing [WWW Document]. Barron's. URL https://www.wsj.com/articles/SB123457667407886821 (accessed 11.22.22).
Stein, J.C., 1989. Efficient capital markets, inefficient firms: A model of myopic corporate behavior. The quarterly journal of economics 104, 655–669. https://doi.org/10.2307/2937861
Vardi N., 2009. The Golden Age Of Activist Investing [WWW Document]. Forbes. URL https://www.forbes.com/sites/nathanvardi/2013/08/06/the-golden-age-of-activist-investing/ (accessed 11.22.22).
Wang, X., Fan, G., Hu, L., 2020. Report on China's Provincial Marketization Index (2019). Social Science Literature Publishing House: Beijing, China.
Wooldridge, J.M., 2010. Econometric Analysis of Cross Section and Panel Data. Book-Econometrics.
Xu, N., Li, X., Yuan, Q., Chan, K.C., 2014a. Excess perks and stock price crash risk: Evidence from China. Journal of Corporate Finance 25, 419–434. https://doi.org/10.1016/j.jcorpfin.2014.01.006
Xu, N., Li, X., Yuan, Q., Chan, K.C., 2014b. Excess perks and stock price crash risk: Evidence from China. Journal of Corporate Finance 25, 419–434. https://doi.org/10.1016/j.jcorpfin.2014.01.006
Yuan, R., Sun, J., Cao, F., 2016. Directors' and officers' liability insurance and stock price crash risk. Journal of Corporate Finance 37, 173–192. https://doi.org/10.1016/j.jcorpfin.2015.12.015
Zhao, W., 2020. Activist Short-Selling and Corporate Opacity. https://doi.org/10.2139/ssrn.2852041
Zhao, Y., Allen, A., Hasan, I., The, S., Analysis, Q., April, N., Zhao, Y., Allen, A., Hasan, I., 2018. State Antitakeover Laws and Voluntary Disclosure. Journal of Financial and Quantitative Analysis 48, 637–668.
Zhao, Y., Chen, K.H., 2009. Earnings quality effect of state antitakeover statutes. Journal of Accounting and Public Policy 28, 92–117. https://doi.org/10.1016/j.jaccpubpol.2009.01.007

Academic Summary

This thesis provides a comprehensive examination of how risk-taking behaviors, corporate sustainability, and corporate governance mechanisms interact to shape firms' risk management approaches. It comprises three interrelated papers investigating different dimensions of corporate risk taking.

The first paper investigates the causal effect of CEO career concerns on general corporate risk aversion. Using a regression discontinuity design (RDD), it demonstrates that missing performance evaluation targets increases CEO career concerns, making CEOs more risk-averse. Specifically, heightened career concerns lead CEOs to favor safer corporate policies including lower capital expenditures, higher cash reserves, and increased dividend payouts. This effect is stronger for newer CEOs and those with a greater proportion of deferred compensation. The paper makes two key contributions. First, it establishes a systematic empirical measurement of corporate risk across profit volatility, stock return volatility, and corporate investment policies. Second, it delineates a causal mechanism from missing performance targets to heightened career concerns and ultimately greater risk aversion. By overcoming endogeneity concerns, it shows career concerns directly impact CEO risk preferences and corporate policies.

The second paper builds on the first by examining the causal effect of career concerns on ESG reputational risk management. Applying the same RDD methodology, it demonstrates that missing performance targets incentivizes CEOs to protect their reputation by reducing exposures to ESG controversies. However, this superficial reputation management comes at the expense of actual improvements in ESG performance. The paper introduces a novel firm-level ESG controversies database to distinguish reputational risk management from substantive ESG engagement. It shows CEOs prioritize immediate ESG reputation protection over long-term ESG performance commitments when facing career concerns. This paper delineates how implicit incentives shape CEOs' trade-offs between reputation management and actual performance.

The third paper analyzes how director nomination eligibility criteria (DNEC) affect stock price crash risk. Leveraging unique hand-collected data from China, it reveals that higher DNEC reduces crash risk by altering board composition and transparency. Using two novel instrumental variables, it establishes a causal link between higher DNEC and lower crash risk. Further tests show this effect is amplified in non-state-owned firms with less executive control, higher stock price volatility, and more retail investors. This paper demonstrates how a specific governance mechanism—DNEC—can mitigate the detrimental effects of short-term institutional investors.

Together, the three papers illustrate the critical roles of formal governance policies and implicit managerial incentives in influencing corporate risk-taking behaviors. Utilizing quasi-experimental RDD and instrumental variables, the papers establish causality through empirical tests. The thesis makes theoretical and empirical contributions to finance literature, while also offering practical insights into corporate risk management and investment risk identification for executives, policymakers, and regulators.

Academische Samenvatting

Deze scriptie biedt een uitgebreid onderzoek naar hoe risicovol gedrag, bedrijfsduurzaamheid en mechanismen voor corporate governance samenwerken om de risicobeheerbenaderingen van bedrijven vorm te geven. Het omvat drie onderling verbonden papers die verschillende dimensies van bedrijfsrisico's onderzoeken.

Het eerste paper onderzoekt het causale effect van carrièrezorgen van CEO's op algemene bedrijfsrisicoaversie. Met behulp van een regressie discontinuïteitsontwerp (RDD) toont het aan dat het niet halen van doelstellingen voor prestatiebeoordeling leidt tot grotere carrièrezorgen bij CEO's, waardoor ze meer risicomijdend worden. Met name verhoogde carrièrezorgen leiden ertoe dat CEO's veiligere bedrijfsbeleidslijnen prefereren, waaronder lagere kapitaaluitgaven, hogere kasreserves en verhoogde dividenduitkeringen. Dit effect is sterker voor nieuwere CEO's en degenen met een groter deel van uitgesteld compensatie. Het paper levert twee belangrijke bijdragen. Ten eerste stelt het een systematische empirische meting van bedrijfsrisico's vast over winstvolatiliteit, aandelenrendementsvolatiliteit en bedrijfsinvesteringsbeleid. Ten tweede schetst het een causaal mechanisme van het missen van prestatiedoelen naar verhoogde carrièrezorgen en uiteindelijk grotere risicoaversie. Door endogeniteitsproblemen te overwinnen, toont het aan dat carrièrezorgen direct van invloed zijn op de risicovoorkeuren van CEO's en bedrijfsbeleid.

Het tweede paper bouwt voort op het eerste door het causale effect van carrièrezorgen op ESG-reputatierisicobeheer te onderzoeken. Door dezelfde RDD-methodologie toe te passen, toont het aan dat het niet halen van prestatiedoelen CEO's stimuleert om hun reputatie te beschermen door blootstelling aan ESG-controverses te verminderen. Deze oppervlakkige reputatiemanagement gaat echter ten koste van daadwerkelijke verbeteringen in ESG-prestaties. Het paper introduceert een nieuwe database op bedrijfsniveau voor ESG-controverses om reputatierisicobeheer te onderscheiden van substantiële ESG-betrokkenheid. Het toont aan dat CEO's onmiddellijke ESG-reputatiebescherming prioriteren boven langetermijnverbintenissen voor ESG-prestaties bij het omgaan met carrièrezorgen. Dit paper schetst hoe impliciete prikkels

de afwegingen van CEO's tussen reputatiemanagement en daadwerkelijke prestaties vormgeven.

Het derde paper analyseert hoe de criteria voor de nominatie van directeuren (DNEC) het risico van een crash van de aandelenkoers beïnvloeden. Met behulp van unieke handverzamelde gegevens uit China onthult het dat hogere DNEC het crashrisico vermindert door de samenstelling en transparantie van het bestuur te veranderen. Met behulp van twee nieuwe instrumentele variabelen, vestigt het een causaal verband tussen hogere DNEC en lager crashrisico. Verdere tests tonen aan dat dit effect wordt versterkt in niet-staatsbedrijven met minder uitvoerende controle, hogere aandelenprijsvolatiliteit en meer particuliere beleggers. Dit paper toont aan hoe een specifiek governance-mechanisme - DNEC - de nadelige effecten van kortetermijn-institutionele beleggers kan verminderen.

Samengevoegd illustreren de drie papers de cruciale rollen van formeel governancebeleid en impliciete managementprikkels bij het beïnvloeden van risicovol gedrag van bedrijven. Door het gebruik van quasi-experimentele RDD en instrumentele variabelen, vestigen de papers causaliteit via empirische tests. De scriptie levert theoretische en empirische bijdragen aan de financiële literatuur, terwijl het ook praktische inzichten biedt in risicobeheer voor bedrijven en het identificeren van beleggingsrisico'svoor leidinggevenden, beleidsmakers en toezichthouders.

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This thesis explores the dynamic interplay between risk-taking behaviors, corporate sustainability, and corporate governance mechanisms. The first paper demonstrates a causal effect of CEO career concerns on reduced corporate risk-taking using regression discontinuity design. It finds that career-concerned CEOs exhibit risk aversion, influencing corporate policies toward safer investments, higher cash reserves, and increased dividends. The second paper illustrates how CEOs facing career anxieties undertake ESG reputational risk management, compromising long-term ESG performance. The third paper shows that higher director nomination eligibility criteria causally reduce stock price crash risk, an effect amplified in non-state-owned firms with lower executive control, volatile share prices, and more retail investors. Collectively, the thesis makes academic contributions to empirical finance and offers practical insights into corporate risk management and investment risk identification for executives, policymakers, and regulators.

Ke Wang (1989) received his PhD degree in Finance from Tilburg University. His research investigates corporate finance topics such as corporate sustainability, governance and risk management using big data and causal inference techniques. Ke Wang is a seasoned investment professional with practical experience spanning debt, equity, and real estate. He currently acts as the investment decision committee member of Guangdong Finance International Investment Co., Ltd. and Supervisor of Guangdong Yu'nan Agricultural Commercial Bank. He previously served as a senior advisor at PwC, working in M&A and assurance services.

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