# Three empirical studies of corporate finance

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## Abstract

This thesis comprises three empirical investigations within the realm of corporate finance. The initial study scrutinizes the ramifications of board reforms, revealing an augmentation in Research and Development (R&D) expenditure but a concomitant diminution in innovation output. The discernible impact of board reforms on firm innovation is contingent upon variances in national structures. Within developed economies characterized by low corruption levels and robust adherence to the rule of law, board reforms impede innovation. Conversely, in emerging economies marked by weaker adherence to the rule of law and elevated corruption levels, board reforms expedite firm innovation output. These findings bear implications for the formulation and execution of board reforms, underscoring the imperative need to avoid reforms that instigate managerial short-termism and disrupt the innovation ecosystem, thereby engendering adverse effects on long-term growth stimulation.

The subsequent two studies investigate the influence of CEO characteristics on firm strategy and decision-making. The second study explores whether CEOs' early experiences with disasters impact the selection of debt structure. Firms led by CEOs who have weathered disasters exhibit a proclivity to transition from bank debt to public debt. The impact of CEOs' early disaster experiences is most conspicuous in circumstances where regulatory oversight is stringent, unemployment risk is lower, and financial distress risk is higher. These findings imply that CEOs' disposition, shaped by early disasters, to undertake additional risks affects corporate debt structure.

The third study delves into whether CEOs' early-life disaster experiences correlate with corporate misconduct. A substantial sample of US public companies spanning the period 2001 to 2020 was scrutinized, yielding no compelling evidence to suggest a significant impact of CEOs with early-life disaster experiences on corporate misconduct. This study contributes to

the comprehension of CEO behavior, particularly for those entrusted with designing and overseeing effective systems of corporate governance.

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# Chapter 1: Introduction

In the current corporate governance landscape, investigating the impact of board reforms and the early-life experiences of CEOs is a compelling subject. As organizations navigate the complexities of a rapidly evolving business environment, understanding the multifaceted impact of governance restructuring and the personal histories of key leaders becomes paramount. This thesis discusses the impact of board-level reforms and individual CEO experiences with early-life disasters on organizational strategies, innovation initiatives, and firm outcomes.

Examining the historical context of board reforms, noting their origins in the 1992 Cadbury Report in the U.K. and subsequent global implementations, including the Chinese Securities Regulatory Commission's 2001 Code of Corporate Governance and the U.S. Sarbanes–Oxley Act of 2002. Theoretical underpinnings from Stein (1988, 1989) suggest that managerial behavior influences firm innovation, with agency problems inducing managerial myopia. While a stronger corporate board may enhance monitoring and mitigate myopia, it could also exacerbate short-termism, posing a challenge to innovation. Importantly, the role of national structures in this dynamic remains unclear, considering varying reform approaches, external governance, corruption levels, and the developmental stage of economies.

The findings of a neuroscience study provide convincing evidence for the stable impact of early traumatic events resulting from natural disasters. Such trauma has the potential to leave lasting imprints, manifesting as scars and leading to significant changes in individuals' preferences (Franklin et al. 2012; Moles et al. 2004). This transformation in preferences is intricately linked to behavioral changes, influencing decisions and choices. Specifically, individuals who undergo traumatic experiences may exhibit alterations in their selection behaviors. Hambrick and Mason's (1984) upper echelon theory posits that an executive's personal experiences play a pivotal role in shaping their characteristics and psychological predispositions. These, in turn,

mold their management style and dictate the formulation of corporate policies. Therefore, gaining a comprehensive understanding of how CEOs with early-life disaster experiences impact organizational decisions stands as a valuable and pertinent area of inquiry.

Chapter 2 investigates on board reforms and firm innovation. The pivotal role of innovation in driving approximately half of total GDP growth, as highlighted by the Organisation for Economic Co-operation and Development (OECD, 2015), underscores the critical importance of understanding the factors that facilitate innovation within a country. Building on Nelson's seminal work in 1991, which explored why firms differ and how corporate governance structures reflect market variations, a substantial body of literature has investigated the impact of corporate governance on firm innovation (Belloc, 2012; O'Connor and Rafferty, 2012). Recent attention has turned towards the consequences of corporate governance reforms on firm innovation following policy changes in numerous countries (Lin et al. 2021). However, the exploration of how national structures influence the nexus between corporate governance changes and firm innovation, at the core of Nelson's argument, remains largely unexplored.

The study of Chapter 2 addresses this gap by examining the heterogeneous impact of corporate governance changes on firm innovation output, utilizing differences in national structures such as reform approach, compliance with the rule-of-law, corruption levels, and market development. Unlike previous studies that focused on the effect of corporate governance reforms while holding national structures constant, this study approach emphasizes the moderating role of country-level features. The overarching objective is to provide a comprehensive understanding of the role played by national structures in stimulating long-term growth. The Chapter 2 contributes to the existing literature by reconciling conflicting findings on the impact of board reforms on innovation output, exploring the moderating effect of national structures, and offering comprehensive evidence on the long-term effects of board reforms on firm innovation. The results highlight the nuanced relationship between corporate

governance, national structures, and innovation, with implications for the design and implementation of future corporate board reforms.

Chapter 3 investigates CEOs with early-life disaster experience and how it impacts debt structure. In recent years, there has been a growing interest in understanding the impact of CEOs' prior experiences on firm decisions, as evidenced by studies such as Bernile et al. (2017), Chen et al. (2021), Malmendier et al. (2011), and O'Sullivan et al. (2021). Drawing on the upper echelons hypothesis proposed by Hambrick and Mason (1984), which posits that previous experiences shape senior executives' cognition and values, subsequently influencing firm behaviours. Chapter 3 delves into the specific realm of CEOs' early-life disaster experiences and their consequential effects on firms' debt structure decisions. Recognizing the long-term effects of early traumatic situations on individuals, particularly those arising from natural disasters, and the subsequent alterations in preferences and behaviours, the study of Chapter 3 explore the potential impact of CEOs' trauma experience on their firms' debt structures.

It is an empirical question of how CEOs with early-life disaster experiences affect their firm debt structure. On the one hand, CEOs with early-life experience may decrease bank debt and increase public debt. Based on bank monitor theory, banks can more successfully supervise borrowing companies (DASS and Massa, 2011; Fama, 1985). Unlike bondholders, due to the concentration of ownership of loan claims, banks have considerable incentives to supervise the management of borrowing firms. As stated in the prior research, CEOs with early-life disaster experiences have a higher risk-tolerance attitude (Chen et al. 2021). In other words, it is expected that the bank will strengthen the supervision of borrowing companies controlled by those high-risk executives. Therefore, risk-loving CEOs may attempt to move away from bank debt and toward public debt to avoid bank-strict regulation. On the other hand, CEOs with early-life disaster experience may increase bank debt. According to the renegotiation theory, firms led by risk-loving leaders have increased their reliance on bank debt because

renegotiating bank debt contracts in the event of financial distress is relatively simple and the conditions are less restrictive than public debt. A firm that takes on more risk with a higher probability of not being able to fulfil its debt contract obligations. Thus, firms under the threat of bankruptcy prefer to borrow bank debt rather than issue public debt because banks are better able to renegotiate the contract or liquidate the firm in the event of bankruptcy (Denis and Mihov, 2003).

Existing literature underscores the significance of debt source in determining a firm's capital structure, categorizing it into bank debt and public debt. Leveraging a comprehensive sample of CEOs born in the United States and merging their biographical data with a database of natural disaster events, we distinguish between CEOs who experienced disasters during their formative years (ages 5 to 15) and those who did not. Employing a fixed effects model with industry and year fixed effects, our results suggest that CEOs with early-life disaster experiences exhibit a preference for issuing public debt over bank debt. To address potential endogeneity concerns, we employ propensity score matching and entropy balancing, comparing treated and control groups to eliminate selection bias. Furthermore, we conduct placebo tests, using a simulated variable to confirm the robustness of our findings. Our contributions to the literature include providing novel evidence on the link between CEO early disaster experiences and debt structure decisions, introducing an individual-level driver to complement existing firm and country determinants of debt structure, and contributing to the emerging body of research on CEOs' early-life exposure to disasters and its impact on corporate policies. Overall, this study enhances our understanding of the multifaceted factors influencing debt structure and emphasizes the substantial influence that CEOs' background experiences wield over strategic decision-making.

Chapter 4 investigates the impact of early-life disaster experiences on CEOs and how these CEOs' behaviour on corporate misconduct. As discussed in Chapter 3, in recent years, there has

been a growing emphasis on understanding how CEOs' prior experiences shape the decisions of firms. From neuroscience study underscores the enduring impact of early traumatic events, especially those arising from natural disasters. The upper echelon theory by Hambrick and Mason (1984) posits that personal experiences affect executives' characteristics and psychological predispositions, influencing their management style and corporate policies. Bernile et al. (2017) and O'Sullivan et al. (2021) have explored the impact of early-life disasters on investment decisions and corporate social performance, respectively, while Chen et al. (2021) focused on stock price crashes. However, the understanding of how such CEOs influence corporate misconduct remains incomplete. Examining various forms of corporate wrongdoing, including accounting impropriety, insider trading, financial reporting revisions, and options backdating, Chapter 4 delves into the empirical question of how CEOs with early-life disaster experiences impact corporate misconduct. Applying risk-taking theory, CEOs who faced disasters may be prone to misconduct as traumatic experiences can diminish the perceived loss associated with risk-taking, boosting risk tolerance. Conversely, the responsibility-enhancing theory suggests that CEOs who weathered adversity may mitigate misconduct, the disaster experience fostering a sense of responsibility and commitment to others.

The study of Chapter 4 utilized CEOs sample born in the United States, biographical data was manually collected and integrated with a natural disaster database. Despite employing a comprehensive fixed effects model, the baseline findings reveal no significant correlation between CEOs with early-life disaster experiences and corporate misconduct. Addressing potential endogeneity, this study employs propensity score matching and entropy balancing, revealing consistent results. Additional analyses, including a binary variable for corporate misconduct and subsample testing, further support the robustness of the findings. By exploring CEO traits and childhood disaster experiences, the study provides nuanced insights, demonstrating that even CEOs with childhood disaster experiences do not impact corporate

misconduct. This research contributes to the understanding of CEO behaviour, particularly their influence on corporate misconduct, expanding the literature beyond the prevalent focus on board influences.

The final chapter of this thesis summarises the key insights gained from our empirical studies on corporate finance. It highlights the noteworthy findings and acknowledges the inherent limitations. These concluding remarks guide a nuanced understanding of the intricate dynamics within the domains of board reforms and CEO early-life experiences.

Our investigation into board reforms has revealed a complex landscape. It is evident that the impact of these reforms on firm innovation is contingent upon national structures. To enhance the effectiveness of these changes, it is important to consider the unique characteristics of each country instead of universally applying reforms. These findings prompt a reassessment of the universal applicability of governance reforms. Our study on the influence of CEOs' early-life experiences on firm strategy has uncovered nuanced insights. It is important to recognize these experiences as influential factors in decision-making processes, which calls for a more holistic approach to leadership development and succession planning. Organizations can benefit from understanding and leveraging the diverse backgrounds of their leaders to foster innovation and strategic decision-making. The comparison of risk-taking theories with responsibility-enhancing theories has enhanced our understanding of how personal histories, particularly those influenced by early-life disasters, shape leadership tendencies. The implications for practitioners and policymakers are significant.

The following chapters of this thesis are organized as follows: Chapter 2 examines the effects of board reforms on innovation. Chapter 3 investigates the impact of CEOs' early-life disaster experiences on debt structure decisions. Chapter 4 discusses the influence of CEOs' early-life disaster experiences on corporate misconduct. Finally, Chapter 5 provides a conclusion that

synthesizes key insights, acknowledges limitations, and discusses broader implications and directions for future research.

# Chapter 2: Corporate Board Reforms and Innovation: The Moderating Role of National Structures

## 2.1 Introduction

According to the Organisation for Economic Co-operation and Development (OECD), innovation accounts for approximately half of total GDP growth (OECD, 2015). What may therefore enable a country to foster more innovation is of vital importance. In this context, Nelson's (1991) seminal work first drew attention on the central question why firms differ and how different corporate governance structures reflect, at least partially, differences in market settings. Since then, a large body of literature has examined how corporate governance affects the level of firm innovative activity (see Belloc, 2012; O'Connor and Rafferty, 2012). Recently, as many countries have implemented a series of policy changes, the attention of academics has been drawn to the effect of corporate governance reforms on firm innovation (see Lin et al. 2021). However, the extent to which national structures affect the corporate governance – firm innovation nexus, the core of Nelson's (1991) argument, is largely unexplored in the literature. In this paper, we use differences in national structures - reform approach, compliance to the rule of law, corruption and market development - to explain the heterogeneous impact of corporate governance changes on firm innovation output. While previous studies focus on the effect of corporate governance reforms on firm innovation holding national structures constant (see Lin et al. 2021), we focus instead on the moderating role of country-level features. Therefore, our overarching objective is to develop a broader understanding of the role of national structures in stimulating long-term growth.

In general, board reforms can be traced back to the 1992 Cadbury Report in the U.K and several widely publicized corporate scandals in the late 1980s and early 1990s. Since then, over 40 countries around the world have implemented corporate board reforms. Amongst them, in 2001 the Chinese Securities Regulatory Commission and the State Economic and Trade Commission

issued a new Code of Corporate Governance for listed companies, and in 2002, the U.S. government published the Sarbanes–Oxley Act in the aftermath of the financial crisis in an attempt to strengthen rules on boards and enhance firm financial transparency.

Theoretically, the work by Stein (1988) and (1989) provide the basis for the possible effect of managerial behavior on firm innovation.[1] The core of the argument by Stein is that agency problems influence innovative activity by inducing managerial myopia. Given the inherently risky nature of innovation, managers that behave myopically will tend to cut long-term investments in risky projects and instead focus on boosting performance in the short-term. The question whether a stronger corporate governance mechanism affects firm innovation is an empirical one. A stronger corporate board may enhance the monitoring of managers, therefore reducing managerial myopia (see Adams et al. 2010; Fama and Jensen, 1983). However, a stronger corporate board may also amplify the negative role of managerial myopia on firm innovation and shift investments to short-term projects (Balsmeier et al. 2017; Faleye et al. 2011).

The role of national structures in this process is less well known. First, countries may adopt different form approaches. Some countries, like the U.K., have opted for a comply-or-explain approach in board reforms that allows firms to non-comply with the reforms provided that provide a justification. Other countries, such as the U.S., use a rule-based approach that requires all firms to comply with the board reforms. Ahmad et al. (2023) find a positive effect of board reforms on R&D but Lin et al. (2021) show that innovation output decreases following the

[1] Prior studies report how board reforms impact firms in several dimensions. For instance, Hu et al. (2020) found that board reforms reduce crash risk by improving financial transparency and investment efficiency. Bae et al. (2020) documented that board reforms strengthen the monitoring role of the board and enable outside shareholders to force management to pay higher dividends. Fauver et al. (2017) found that board reforms increase firm value by eliminating friction between shareholders and executives.

board reforms.[2] In this paper, we reconcile this difference. Second, external governance complements internal governance and improves efficiency (Acharya et al. 2011). Aghion et al. (2013) show that a greater share of institutional ownership, thus better external governance, is associated with more innovation output and Nguyen and Jaramillo (2014) demonstrate that the return to innovation is higher in countries with better institutions. In this paper, we use adherence to the rule-of-law as an external governance indicator that reflects differences in national structures. Third, there is a strong negative relationship between the level of corruption and economic growth (see Mauro, 1995) indicating that the corruption is also an impediment to firm innovation. Indeed, for a sample of U.S. firms, Huang and Yuan (2021) show that corruption impedes innovation and for a private firm, Paunov (2016) show that corruption reduces the likelihood of firm innovation. Therefore, the level of corruption is expected to have a significant effect in the ability of board reforms to affect innovation output. Forth, there is considerable literature on the determinants of firm innovation in developed economies (see Baumol, 2002) as well as literature on the barriers to innovation for emerging economies (see Zanello et al. 2016; Ayyagari et al. 2011). In effect, as Lundvall (1999) correctly notes national business systems and institutional environments interact with national innovation systems that may impede or foster innovation and thus economic development. Emerging economies typically have weaker corporate governance and institutional settings. We therefore expect that board reforms will have a weaker effect on firm innovation in emerging than in developed economies.

In summary, whilst there is some international evidence to suggest that corporate board reforms affect innovation input and output (see Ahmad et al. 2023; Lin et al. 2021), the direction and magnitude of this effect is not clear ex-ante, in part because of multiple channels of influence.

[2] In similar research for specific countries, Bargeron et al. (2010) and Driver and Guedes (2012) show that governance reforms have a negative effect on firm innovation for US and UK firms, respectively.

Indeed, we argue that this relationship is moderated by local factors such as the level of economic development and adherence to the rule of law. We leave this as our empirical research question.

To directly answer this research question, we use a comprehensive sample of board reforms and firm innovation output across 27 countries. We exploit the quasi-natural experiment of board reforms that allows us to provide estimates of the casual relationship between board reforms and firm innovation. We use a Difference-in-Differences (DID) design that includes industry, country, and year fixed effects. Because the timing of board reforms vary across countries, we avoid a potential identification bias in our difference-in-difference (DID) specifications. Further, we use innovation output as our innovation measure as well as R&D expenditure as a control variable, which allows us to disentangle the effect of reforms on firm innovation.[3]

We report a number of findings. We show that board reforms are associated with a reduction in innovation quality and quantity but an increase in R&D expenditure. In general, board reform enforcement leads to an average decrease in patent count of approximately 16.83% and an average decrease in patent citations of approximately 11.24%. We show that the effect of board reforms on innovation output is persistent for up to five years after the implementation of the reforms. Reforms that increase board independence and transparency induce managerial myopia, leading to adopting a short-term focus and hurting long-term innovation. However, we find no evidence that different reform approaches - rule-based or comply-or-explain - affect firm innovation output.

[3] This is important as previous studies have only looked at one side of innovation. For example, Brown et al. (2013) and Ahmad et al. (2023) use R&D in their specifications and Lin et al. (2021) use patent-based measures of innovation.

Importantly, we show that the impact of board reforms on firm innovation is determined by differences in national structures. In developed economies, with low levels of corruption and strong adherence to the rule of law, board reforms tend to impede innovation. In contrast, in emerging economies, with a weaker adherence to the rule of law and high levels of corruption, board reforms accelerate firm innovation output. Our results are robust to various subsample specifications and robustness tests.

Our contribution is threefold. First, we reconcile the different findings that board reforms are associated with an increase in innovation input (Ahmad et al. 2023) but a decrease in innovation output (Lin et al. 2021). This is important as it indicates that there are potentially other channels of influence that lead to the negative effect of board reforms on firm innovation output. Second, nascent literature indicates how national and firm-level characteristics affect innovation output (see Ghoul et al. 2023 and Fiordelisi et al. 2019). We are the first to document the moderating effect of national structures in the board reform – innovation nexus. From an innovation perspective, this outcome underlines how important it is to recognize that national structures shape corporate governance structures. Third, we provide further comprehensive evidence that board reforms have a negative impact on innovation output. Previous literature is rather limited and mostly concentrated on specific reforms or specific countries (for example, see Balsmeier et al. 2017). In this paper, we build on this emerging literature and add to it. We go beyond existing studies to examine the long-term effects of board reforms on firm innovation and examine the mediating impact of R&D expenditure.

Our results have implications for the design and implementation of corporate board reforms. Reforms that align the CEO interests with the long-term viability of the firm and also remedy some of the negative effects of national structures will tend to enhance firm innovation. However, reforms that induce managerial short-termism and disrupt the innovation ecosystem will have negative effects in stimulating long-term growth.

The remainder of the chapter proceeds as follows. In Section 2, we offer a background to board reforms and firm innovation. In Section 3, we discuss our data, the construction of variables and research design. In Section 4, we present the results and in Section 5, we conclude.

## 2.2 Background and hypothesis development

### *2.2.1 Board reform*

Following several widely publicized corporate scandals in the late 1980s and early 1990s, the U.K. issued the landmark Cadbury Report, which sets out recommendations for corporate governance practices. The Cadbury Report, along with the Greenbury Report, provides an important framework for the development of corporate governance codes across countries. Recognizing the importance of sound corporate governance systems, countries around the world have launched reforms focusing on the role and composition of corporate boards. These reforms are intended to improve corporate governance practices and promote greater managerial accountability (Hu et al. 2020). For instance, in the emerging market, to raise Chinese corporate governance standards in line with international best practices, the Chinese Securities Regulatory Commission and the State Economic and Trade Commission issued a new Code of Corporate Governance for listed companies in January 2001 (Code). It was effective from the date of issuance. The Code strictly follows the OECD Principles of Corporate Governance. The year of the corporate governance reform is defined as 2001 when the Code was enacted and international standards were enforced on listed Chinese firms. Black and Khanna (2007) provide an overview of the history of corporate governance reform policy in India which is called Clause 49. The most relevant aspect of the reform is a required change in the composition of the board of directors: at least 50% of the board had to consist of non-executive directors. Perhaps a more notable case is the one in the mature market which is the 2002 Sarbanes–Oxley Act in the U.S., which “strengthened rules on board independence and the role of audit committees, tightened reporting and disclosure requirements, mandated

certification of financial statements by the CEO and CFO, and established the Public Company Accounting Oversight Board, with a mission to oversee audits of public companies and related matters" (Kim and Lu, 2013).

Prior studies prove that board reforms improve the board structure, improve board independence. Board changes were associated with changes in firm-specific fundamentals. Companies changed board structures in either direction as underlying firm fundamentals changed, consistent with the pursuit of economically efficient board structures (Cicero et al. 2013). Board reform reduces the contradiction between the board and the management, also helps to reduce the friction between the board and stakeholders. Prior work suggests that board reforms mitigate agency conflicts between corporate insiders and outside investors. For instance, Hu et al. (2020) find that board reforms reduce crash risk by improving financial transparency and investment efficiency. Bae et al. (2020) document that board reforms strengthen the monitoring role of the board and enable outside shareholders to force management to pay higher dividends. Fauver et al. (2017) expand on Kim and Lu (2013) and collect additional information on corporate governance reforms worldwide from the World Bank, the European Corporate Governance Institute, and local stock exchange regulators. They find that reforms involving more representation from outsiders like board independence, but not reforms involving separation of chairman and CEO positions, lead to greater increases in firm value.

### *2.2.2 Innovation*

What makes a firm innovative? Innovation, as a concept, refers to the process that an individual or organization undertakes to conceptualize brand new products, processes, and ideas (exploration), or to approach existing products, processes, and ideas in new ways (exploitation). Innovation refers to creating more effective processes, products, and ideas. For a company, it could mean implementing new ideas, improving services or creating dynamic products. It can

act as a catalyst that can make the firm's business grow and can help the entrepreneur adapt to the marketplace. Innovation is complex, uncertain, somewhat disorderly, and subject to changes of many sorts (Kline and Rosenberg, 2010).

Recently studies give new eyesight of innovation. Knowledge spillovers give scholars a new cognitive vision of innovation (Audretsch and Belitski, 2020). Knowledge is the product of investment decision-making of profit-seeking firms. Knowledge which has a spillover effect and external benefits is different from commodities. When enterprises rely on knowledge to do innovation, the success innovations change to patents. Firms can not only obtain the benefits brought by patents but also improve the reputation of enterprises. Moreover, interest in open innovation has skyrocketed in the last decade (Dahlander and Gann, 2010; Dahlander et al. 2021). In the era of knowledge economy, enterprises only rely on internal resources for high-cost innovation activities, which has been difficult to adapt to the rapid development of market demand and the increasingly fierce competition among enterprises. Enterprises should actively seek suitable business models such as external joint venture, outsourcing research, technology partnership, strategic alliance or venture capital to turn innovative ideas into real products and profits as soon as possible. In addition, to keep their leading position in the industry, companies prefer to form a set of innovation ecosystems (Granstrand and Holgersson, 2020). Through innovation ecosystem, forming a mature innovation system to strengthening innovation capability. Firms improve their innovation by various axis, which is obviously that innovation is an indispensable part of a firm.

Many studies prove that corporate governance has a direct or indirect impact on corporate innovation (Miozzo and Dewick, 2002; Becker-Blease, 2011; O'Connor et al. 2012; Sapra et al. 2014; Belloc et al. 2016). Miozzo and Dewick (2002) used an interview survey to try to figure out how corporate governance affects innovation. Bad corporate governance firms have less innovation. One of the reasons is that with more innovation investment in such enterprises,

more hostile acquisitions may be faced. Because of the weak governance ability of enterprises, they are hard to resist hostile acquisitions, so they reduce innovation investment to reduce hostile acquisitions attractive (O'Connor et al. 2012). Sapra et al. (2014) show that the interaction between external acquisition pressure and internal managers' interests has a significant impact on enterprise innovation, and the relationship between them and innovation is a U-shaped curve. The reason why the formation is the U-shaped curve result from the different market conditions: the complete corporate control market or the effective anti-takeover legal control market.

Some studies have further considered the influence of the board of directors on innovation in corporate governance. Boards may directly resist exploration of new areas if they fear that in the short-term the stock market fails to properly value investments in innovation (Stein, 1989; Cohen et al. 2013). Relying on regulatory changes for identification, Balsmeier et al. (2017) document that firms that transition to independent boards patent and claim more and that their patents receive more citations. Increased monitoring from independent boards may alleviate agency problems such as shirking or tunneling of corporate resources. Managers should also take actions that are—and appear to be—closer to the interests of shareholders. When under increased scrutiny and demands for results, managers will focus on quantifiable results, such as a greater number of patents. Lu and Wang (2018) research also support that independent directors facilitate corporate innovation because independent boards promote managerial risk-taking. Especially for those large companies, companies without technological innovation, and low-competition companies, independent board impact on innovation is particularly significant.

### *2.2.3 Hypothesis development*

There are two dimensions of firm innovation, namely inputs and outputs. Inputs are related to efforts of innovation invest and are generally identify by R&D activities. Board reforms may incentive R&D expenditure by improve corporate governance through imposing or

recommending greater board independence, audit committee and auditor independence, and separation of the chairman and chief executive officer (CEO) positions (Fauver et al. 2017; Hu et al. 2020; Kim and Lu, 2013; Li et al. 2020). Jensen and Meckling (1976) suggest that agency problems are an inherent part of modern corporations with diffuse ownership structures. The executives who run the firm are differ from the shareholders. It is difficult or costly for shareholders to supervise executives, executives will be motivated to engage in the behavior of maximizing their utility, rather than the behavior of maximizing shareholders' wealth (Jensen and Meckling, 1976). Shareholders prefer to spread the firm's unique risks because they can hold a wide portfolio of assets. In contrast, most of executive's wealth (such as salary, allowance and professional reputation) is directly related to the company. Therefore, executives are usually more risk averse than shareholders, this is the reason why executives usually prefer to invest in low-risk assets rather than high-risk assets. The exist of frictions prevent firms from investing in good projects that can increase shareholder value. A strengthen corporate governance after board reforms can especially eliminate certain frictions (Fauver et al. 2017). Hence, board reforms reduce the agency problem to stimulate executives do risky investment. Therefore, we predict that:

*H1: Board reforms increase firm R&D expenditure.*

Another dimension of firm innovation is outputs which are identified by firm patent count and patent citation. Board reforms may have positive affect on firm R&D expenditure, but whether board reforms have positive affect on firm patent is doubt. Board reforms will increase board size by employing independent directors or separate CEO and Chairman position. The argument is that large board size creates communication and coordination problems (Cheng, 2008). Goodstein et al. (1994) suggest that larger boards may prolong the decision-making process by presenting very divided positions and even personal interests, thus hard to achieve the firm's goals in the long term. The increase of information transmit cost is the example of

this view. Before board reforms, controlling power is concentrated on a small group of board members. Therefore, they can make decisions and assign managers to implement their decisions directly. After the board reforms, the process of implementing decisions becomes cumbersome. For example, some board reforms require firms separate the CEO and Chairman. However, dual leadership allows firms to make speedier decisions and react more quickly to new information than separate leadership because the former eliminates an extra chain of command (Yang and Zhao, 2014). The notion is that information is an indispensable dimension of firm innovation production (Daghfous and White, 1994), the low efficient board result in inefficient information transmit will reduce firm innovation output. Hence, we predict:

*H2: Board reforms decrease firm patent count and citation.*

## 2.3 Data, Variable Construction, and Research Design

### *2.3.1 Data*

We collect data on innovation output from the EPO Worldwide Patent Statistical Database (PATSTAT, 2021 Spring Edition). In contrast with the widely used NBER Patent data, which only include patents granted by the US Patent & Trademark Office (USPTO), PATSTAT contains bibliographic information on more than 100 million patent applications and awards in over 100 patent offices around the world.[4] We follow the patent literature and focus on utility patents only (Levine et al. 2017).

We obtain data on major board reforms during 1990-2015 from Fauver et al. (2017) who rely on the World Bank, the European Corporate Governance Institute, local exchanges, and primary regulators, as well as previous studies (Kim and Lu, 2013) as sources on board reforms.

[4] Although many studies on innovation use USPTO data on the assumption that all important patents around the world are also enforced in the US, which is the largest technology consumption market (Hsu et al. 2014), Chang et al. (2015) argue that firms in many emerging economies do not submit patent applications to the USPTO. Thus, using USPTO data may underestimate innovation by non-US firms.

These reforms offer quasi-natural experiments that mitigate endogeneity concerns by allowing us to isolate the causal effects of corporate governance on firm innovation.

To obtain data on firm financial characteristics, we rely on Compustat. Country-level data is extracted from the World Bank's WDI database.

### *2.3.2 Measuring innovation search*

As we discuss above, there are two ways to identify innovation. The direct way which uses patent data and indirect way which uses R&D expenditure (Amore and Bennedsen 2016; Atanassov 2013; He and Tian 2013; Balsmeier et al. 2017).

The patent data are collected from PATSTAT from the year 1990 to 2015[5]. The PATSTAT patent database is an integrated database that includes data from more than 100 patent offices around the world (Dernis et al. 2014). The PATSTAT database classifies patent data according to different standards. Each sub-database contains different information about patents, such as the patent-family size of the patent, the country where the patent belongs, and so on.

Follow Fang et al. (2014) study, we caputure the two vital factors of innovation. The first is quantitative factor of innovation, *Pat_num*, refer to the natural logarithm of the number of patent applications a firm file in a year that are eventually granted plus 1. Using a patent's application year instead of its grant year as the application year is argued to better capture the actual time of innovation (Griliches et al. 1988). To further assess a patent's influence, we construct a second measure of quantitative of innovation by counting the number of non-self-citations. The citation counts, *Pat_cite*, refer to the natural logarithm of patents non-self-citations in that year plus 1. As a patent can keep receiving citations over a long period of time, which means that early year patents are cited more than recently patents. To eliminate this influence, we restrict citation time window with three years.

We also apply R&D expenditure to capture innovation in our study. We collect R&D

[5] We collected innovation data for 2015 because the board reforms data was updated for 2015 (Fauver et al. 2017).

expenditure data from Compustat. Following Chen et al. (2020) study, we calculated R&D expenditure, *Delta_R&D*, by R&D at current year minus last year R&D expenditure divided by lagged total asset.

### *2.3.3 Board reforms*

The details of corporate governance reforms vary by country, but a common objective is to strengthen investor rights by changing the practices pertaining to, e.g., the board of directors, external auditors, disclosure requirements, and protection of minority shareholders. We obtain data on major board reforms during 1990-2015 from Fauver et al. (2017), who rely on the World Bank, the European Corporate Governance Institute, local exchanges and primary regulators, and previous studies (Kim and Lu, 2013) as their sources on board reforms. We identify whether major board reforms cover three key components of board practices: board independence, audit committee and auditor independence, and separation of the chairman and CEO positions. These reforms offer quasi-natural experiments that mitigate endogeneity concerns by allowing us to isolate the causal effects of corporate governance on firm innovation. Follow prior literature, we classify major board reforms into two approaches: comply-or-explain and rule-based reforms. The comply-or-explain, which is "soften", is reforms (codes of best practices) typically involve publication of governance codes, with firms choosing to adopt the recommendations or explain why they do not comply. Rule-based reforms, which is mandatory, typically involve enactment of company laws or securities regulations that require firms to follow specified governance practices[6]. The major board reform data are shown in Appendix A.

### *2.3.4 Control Variable*

We control for firm and country characteristics that may affect a firm's future innovation (see

[6] In our study, we do not address other board reform components and their potential impact on firm innovation (see Griffin et al. 2021). This will be the focus of future research.

Ahmad et al. 2023, Bae and Goyal, 2009; Qian and Strahan, 2007). At firm level, all variables are computed for firm *i* over the fiscal year *t*. We use the natural logarithm of total assets (in U.S. dollars) to measure *Firm Size*, which has a positive effect on firm innovation. The ratio of total debt to total assets to calculate *Leverage*, which has a negative effect on firm innovation. The ratio of cash equivalents to total assets to capture cash flow (*Cash*), which has a positive effect on firm innovation. The Market-to-Book ratio (*MTB*), calculated by dividing the market value by the book value, which has a positive effect on firm innovation (see Ahmad et al. 2023). For macroeconomic conditions, we follow previous studies (Bae and Goyal, 2009; Qian and Strahan, 2007) and control for GDP and GDP per capita. GDP is defined as the natural logarithm of real Gross Domestic Product (*WDI_GDP*) measured in 2010 U.S. dollars, and GDP per capita (*WDI_capita*) is the natural logarithm of real GDP per capita measured in 2010 U.S. dollars. All variables are defined in Appendix B.

### *2.3.5 Descriptive Statistics*

Follow prior study, we remove any observations with zero, negative, or missing total assets, then any remaining missing values of R&D are replaced with zero. We exclude firms in financial industries (Standard industrial classification codes 6000–6999)[7]. To minimize the effect of outliers, we also winsorize all variables at the top and bottom 1% of each variable's distribution. Table 1 reports the summary statistics of the key variables. In our sample, we have 50754 samples from 27 countries. According to Table 2.1 Panel A, we can find that Japan and US have the most sample distribution which are 35% and 41%. The sample statistics is almost the same with period study (see Bae et al. 2021; Fauver et al. 2017; Hu et al. 2020). The correlation between variables is in Appendix C.

[7] We exclude firms in the financial industry from the sample because the financial sector operates under distinct regulatory frameworks and financial practices compared to other industries. These differences can lead to variations in innovation processes and outcomes that are not representative of the broader market. Including financial firms could skew the results and limit the generalizability of our findings to non-financial sectors. Therefore, to maintain the integrity and relevance of our study, we focus solely on non-financial firms.

**[Insert Table 2.1 Here]**

### *2.3.6 Research Design*

To detect a causal effect of board reforms on firm innovation (and to avoid endogeneity issues), our identification strategy is based on a Difference-in-Differences (DiD) regression approach, where the main event is the implementation of the board reform. Then, we analyze changes in the innovation input and output of firms in the treatment group, before and after the introduction of the board reforms. We compare such changes with the firms in the control group. The control group includes firms in countries that did not take board changes that year. Specifically, we estimate the following regression model:

$$Innovation_{i,j,t+1} = \alpha + \beta Post_{j,t} + \gamma_1 T_{i,j,t} + \gamma_2 Z_{j,t} + \delta_i + \varepsilon_{i,j,t} \quad (1)$$

Where $i$ indexes firms, $j$ indexes countries, and $t$ indexes time. The dependent variable $Innovation_{i,j,t+1}$ is calculated by patent count, patent citation and R&D expenditure. $Post$ is our main independent variable. We set $Post$ equal to one since a country $j$ in year $t$ adopts a major board-related reform for the first time, otherwise zero. Our variable of interest is the coefficient $\beta$ on $Post$, which captures the change in innovation among firms after the reform, relative to the change in innovation among firms without board reforms during the corresponding years. Note that board reforms are staggered over time. Thus, all firms in countries where board reforms were already in effect are used as the treatment group, and those in countries where reforms were not yet in effect in year $t$ are assigned to the control group.

To assuage potential firm-level ($T_{i,j,t}$) omitted-variable problems, we control firm size ($Firm\_size$), leverage ($Leverage$), cash ($Cash$) and market to book ratio ($MTB$) that have shown to affect innovation (Bernstein, 2015; Balsmeier et al. 2017; Mann, 2018). In addition to firm-level determinates, we introduce a battery of frequently used country-level variables ($Z_{j,t}$). We also control for fixed effects ($\delta_i$), including industry-level, country-level, and year-

level[8]. This approach implicitly takes as the benchmark group all firms from countries without reforms as of a particular time and is commonly used in prior literature (Bertrand and Mullainathan, 2003).

## 2.4 Empirical Results

### *2.4.1 Causal Effects of Board Reforms on Innovation*

In this section, we investigate the causal effect of board reforms on firm innovation. We estimate Eq. (1) with standard errors adjusted for country clustering. As a first step, we run unconditional regressions with industry, country, and year fixed effects. These fixed effects identify the within-industry, within-country, and within-year changes in firm innovation between treatment and control firms after the implementation of board reforms. We present the results in Table 2.2, Columns 1-3. Patent count and patent citations decrease significantly after the adoption of major board reforms. In contrast, R&D expenditure increases after the board reforms. Under this specification, we find that board reform enforcement leads to an average decrease in patent count of approximately $16.83\%\ (= -0.205/1.218)$ and an average decrease in patent citations of approximately $11.24\%\ (= -0.130/1.157)$. As for R&D expenditure, after board reforms result in an average increase of about $1.17\ (= 0.007/0.006)$, which is a significant improvement. We further test the moderation effect of R&D on patent counts and citations after board reforms. The results are shown in Table 2.2, Columns 4 and 5. Both coefficients of Post are significant and negative, and *Post*R&D* is significant and positive[9]. These results suggest that while board reforms might streamline governance and

[8] Given the limitations of our dataset, interacting country fixed effects with time fixed effects could lead to overfitting, especially the number of observations of some countries is limited. We aimed to avoid introducing too many parameters relative to the number of data points, which could reduce the statistical power of our analysis.

[9] We conducted preliminary tests by including the R&D variable and found that coefficient of the post is statistically significant and aligns with theoretical expectations. See appendix D.

potentially introduce stricter oversight, leading to fewer patents and citations, they also encourage firms to invest more in R&D. This increase in R&D expenditure could be a strategic response to maintain competitiveness and foster long-term innovation capacity. The decrease in patent count and citations could reflect a shift towards more quality-focused innovation strategies or longer-term projects that are not immediately patentable. The implications of these findings are significant. Policymakers and stakeholders should consider that board reforms, while beneficial for governance, might initially suppress measurable innovation outputs like patent counts and citations. However, the positive moderation effect of R&D expenditure indicates that increased investment in research and development can counterbalance these negative effects and potentially lead to more sustainable and impactful innovation in the long run. This highlights the importance of supporting R&D activities concurrently with the implementation of board reforms to ensure that firms do not experience a decline in innovation performance.

**[Insert Table 2.2 Here]**

For robustness, we introduce a dynamic model, therefore controlling for any systematic differences in innovation prior the reforms taking place. To this end, we replace $Post$ with indicator variables that examine the effect of the reforms before and after they take effect. The new indicators include: $Year\ 2\ and\ 2-\ before\ board\ reforms$, which equals one for the two years and two years prior to the reform taking effect[10]. $Year\ of\ board\ reform$, which equals one for the year in which the reform takes effect. $Year\ 1\ after\ board\ reform$, which equals one for the year following the reform taking effect, and $Year\ 2\ and\ 2+\ after\ board\ reform$, which equals one for the two years and subsequent years after the

[10] For example, a board reform that takes effect in the year 2005. Using this as the reform year, the variable would be defined in the following manner: The variable equals 1 for the years 2003 and before 2003. The variable equals 0 for all other years.

reform takes effect, and zero otherwise. If the baseline results hold, we expect to see insignificant coefficients before the board reforms take effect, and a significant decrease in patent counts and citations and a significant increase in R&D expenditure when the board reforms take effect and afterwards. We report the results of the dynamic regression analysis in Table 2.3. We show that there was no significant changes to firm innovation input and output prior to the reforms. $Year\ 2\ and\ 2-\ before\ board\ reforms$ is statistically insignificant. In line with our baseline results, $Year\ of\ board\ reform$ is negatively and statistically significant for patent count and patent citations and positive and statistically significant for R&D expenditure. The negative (positive) effect for innovation output (input) remains two years after the reforms.

**[Insert Table 2.3 Here]**

The above set of results reconcile the differences observed in two recent studies. Lin et al. (2021) show that board reforms have a negative effect on firm innovation output and Ahmad et al. (2023) report a positive effect of board reforms on R&D expenditure. Our results confirm that board reforms have a negative impact on firm patent counts and citations, but the positive impact of R&D expenditure eliminates this negative effect. This is important as it indicates that there are potentially other channels of influence that lead to the negative effect of board reforms on firm innovation output. Given that R&D is an incomplete measure of firm innovation, in the subsequent analysis, we focus on innovation output measures only.

### *2.4.2 The Impact of different approach to the reform*

In this subsection, we investigate the effect of different approach of board reform. As indicated above, governments choose whether to offer rule-based or comply-or-explain reforms to firms operating in their country (see Fauver et al. 2017). Our objective is therefore to investigate whether the choice of the reform had any effect in the impact of board reforms on firm innovation.

In principle, rule-based reforms are mandatory, while comply-or-explain reform are voluntary. To determine the effect of different board approaches on firm innovation, we use the interaction between the board reform dummy ($Post$) and the comply-or-explain ($Comply$) dummy. An insignificant interaction coefficient *Post*comply* would indicate that differences in board approaches do not affect the reform–innovation nexus. We report the regression results in Table 2.4. The coefficient for *Post* is negative and statistically significant, further proving that board reforms have a negative impact on firm innovation. However, the coefficient for *Post*comply* is insignificant. This indicates that differences in reform approaches have no effect on the way board reforms affect innovation. The results are consistent with the view that exogenous interference with the innovation ecosystem has detrimental effects on innovation output, irrespective of the binding nature of the reforms.

**[Insert Table 2.4 Here]**

### *2.4.3 The Moderating Impact of National Structures on The Board Reform – Innovation Nexus*

In this subsection, we investigate the effect of national structures in moderating the board reform – innovation nexus.

First, we examine the impact of board reforms on firm innovation under different external governance conditions. Internal governance can mitigate agency problems and ensure that firms have substantial value even with little or no external governance by investors. External governance, even if crude and uninformed, can complement internal governance and improve efficiency (Acharya et al. 2011). Therefore, strong external governance can incentivize firm innovation. However, unnecessary board reforms can destroy the optimal corporate governance of firms, resulting in strong external governance being impacted more than weak ones. Hence, after major board reforms, we expect that countries with strong external governance will experience a more significant decrease in firm innovation. Following Chen et al. (2020), we

use the Rule-of-Law index to classify countries with weak and strong external governance. The Rule-of-Law index is collected from the World Governance Indicators. We classify a country as having weak external governance when the Rule-of-Law index is lower than the sample countries' median in the year prior to the introduction of major board reforms, and strong external corporate governance otherwise. We present the results in Table 2.5, Panel A. Post is statistically insignificant in countries with weak rule of law but negative and highly significant for countries scoring high in the rule of law index. Economically, this finding suggests a decrease in patent count of approximately 15.52% $(= -0.189/1.218)$ and a decrease in patent citations of approximately 11.84% $(= -0.137/1.157)$. The results confirm our hypothesis that board reforms have a more significant impact in countries with strong external governance.

**[Insert Table 2.5 Here]**

Second, we investigate the effect of board reforms on innovation output, separately for countries with weak and strong institutional environments. To measure institutional environment by country, we use the corruption index from the Transparency International's corruption perceptions index database (see Sanyal, 2005). Transparency International's flagship research product, the Corruption Perceptions Index (CPI), has become the leading global indicator of public sector corruption. CPI from Transparency International began in 1995. The index offers an annual snapshot of the relative degree of corruption by ranking countries and territories from all over the globe. In our sample, we have 27 countries. We use the CPI score of each country from Transparency International's Corruption Perceptions Index database. Then we apply the 2015 CPI score as a benchmark and group countries as having low or high corruption by country-level CPI median score. We report the results in Table 2.5, Panel B.

We find that board reforms have a negative and statistically significant effect for firms operating in countries with low corruption but a positive and statistically significant effect for

firms operating in countries scoring high in the corruption index. This result indicates that in countries where the institutional environment is weak, board reforms are successful in aligning corporate governance with the long-term objectives of the firm.

Third, we estimate the baseline regression again, separately for emerging and developed economies. We follow Bhattacharya and Daouk (2002) and classify markets to emerging and developed [11]. Emerging economies typically have weaker corporate governance and institutional settings. Additionally, the regulations and legal systems in emerging economies are not as robust as in developed economies. Therefore, the negative impact of unnecessary board reforms may not be as significant in emerging economies. In contrast, in developed economies, unnecessary board reforms can destroy a firm's optimal corporate governance. Therefore, we expect that board reforms will lower firm innovation in developed economies more than in emerging economies.

We test this hypothesis in Table 2.5, Panel C. The coefficient for *Post* is not statistically significant for emerging economies. On the other hand, board reforms lower firm innovation output in developed economies. On average, firms in developed economies realise a decrease in patent count of approximately 14.54% ($= -0.164/1.218$) and a decrease in patent citations of approximately 10.98% ($= -0.127/1.157$).

Overall, these results demonstrate that the impact of board reforms on firm innovation is significantly moderated by national structures. The results are in general in line with our conjecture that "one-size-fits-all" board reform policies may have the opposite from the anticipated results in firm innovation as firms operate within national structures that impact the effectiveness of the results. One possible explanation for the set of results presented in Table 5 is that that the effectiveness of board reforms on innovation is moderated by the enforceability

[11] See Bhattacharya and Daouk (2002) study Table 1, specify classifying the sample countries in developed and emerging countries.

of the reforms and the strength of the exogenous national governance systems. Therefore, in developed economies, with low levels of corruption and strong adherence to the rule of law, board reforms tend to impede firm innovation. On the other hand, in developing countries, with a weaker adherence to the rule of law and high levels of corruption, board reforms may tend to firm innovation output. In the following section, we conduct further tests that allow us to understand this further but also to ensure robustness of our results.

### *2.4.4 Robustness Tests*

We decompose board reform to their components. Board reforms mainly focus on three different segments: (i) increasing the requirements for the presence of independent directors, (ii) separating the CEO role from the chairman of the board role and (iii) introducing independent audit committees and in general strengthening their function in order to improve corporate transparency. In Table 2.6, we examine the contribution of each of these changes in firm innovation output. To this end, we create three different indicator variables: *Post_Board_Independence* is a dummy variable that equals zero in the years prior to the reform and one otherwise. We define *Post_CEO_Chairman_Duality* and *Post_audit_Committee* in a similar way.

**[Insert Table 2.6 Here]**

The results in Table 2.6 confirm the baseline results that board reforms have a negative impact on firm innovation quantity and quality. Also, in line with the main results, R&D expenditure moderates the negative impact of board reforms on innovation output. However, not all components of board reforms are associated with statistically significant changes in innovation. The decrease in the number of patents is mainly associated with reforms that enforce board independence and the improvement in corporate transparency. Equally, the negative effect of board reforms on innovation quality is driven by the presence of an audit committee and the increase in transparency. The latter result is not surprising as a greater and more efficient

scrutiny over the CEO (which is achieved with the increase in board independence and the presence of an audit committee) may increase short-term pressure and force CEOs to focus on short-term performance instead of adopting a more long-term but riskier investment agenda. This reform-induced managerial myopia seems to be having detrimental effects in firm innovation output, not only in terms of innovation quantity but also in innovation quality.

Further, to determine if the results are driven by the US or by concurrent changes unrelated to the board reforms, we repeat our analyses after excluding US firms. Also, in order to reduce concerns of overrepresentation by Japanese firms, we limit our sample to non-Japanese firms. To decrease the standard error of subsample testing, we cluster the results at the firm level. The results are shown in Table 2.7. Across all subsamples, the coefficient estimate for *Post* is negative and significant at the 1% level.

**[Insert Table 2.7 Here]**

Finally, we investigate whether board reforms have a long-term impact on firm innovation quality and quantity. To this end, we the impact of board reforms on innovation 2 to 5 years after their implementation. As Pastor and Veronesi (2012) have noted, governments change rules from time to time, resulting in varying reactions in financial markets. These reactions are weak if the change is widely anticipated, but they can be strong if the markets are caught by surprise. Policy changes are not always exogenous, as they are determined by a variety of economic and political forces. Some changes are unprecedented, with long-term effects that are difficult to predict in advance. We use data with a 2-to-5-year lag after the implementation of board reforms to understand whether board reforms have a long-term impact on firm innovation.

We present the results in Table 2.8. For innovation quantity, board reforms tend to have a negative and statistically significant impact five years after the implementation of the reforms. For innovation quality, board reforms have a negative and statistically significant effect four

years after their implementation but significance disappears in year five. Overall, the results tend to suggest that even for longer horizons, board reforms are associated with a deterioration in the innovation output of the firm.

**[Insert Table 2.8 Here]**

## 2.5 Conclusion

This study investigates the moderating effect of national structures on the possible impact of corporate board reforms on firm innovation output. This is important because whilst corporate board reforms may signal an exogenous interference with the innovation ecosystem, countries operate under a variety of national structures, which may affect the effectiveness of the reforms. This argument is in line with Nelson's (1991) seminar work on how market settings lead to differences in corporate governance structures.

From a Schumpeterian perspective, board reforms may be detrimental to firm innovation if they disrupt the creative destruction process. In that sense, national structures will magnify or moderate the impact of board reforms on firm innovation. Given the lack of theoretical consensus, the question of the effects of national structures is an empirical one.

We start our paper by providing direct empirical evidence of the relationship between board reform and firm innovation. Using a DID analysis, we examine the effect of board reforms on the count and citation of patents across 27 countries. Our results indicate that firms that adopt board reforms experience reductions in innovation. In general, board reform enforcement leads to an average decrease in patent count of approximately 16.83% and an average decrease in patent citations of approximately 11.24%.

We then investigate the differentiating impact of board reforms on firm innovation by board reform approaches and national structures. We initially find no evidence that different reform approaches - rule-based or comply-or-explain - affect firm innovation quantity or quality. However, when we look at differences in national structures, we show that the latter are

important determinants of the differential impact of board reforms on firm innovation. In particular, in developed economies, with low levels of corruption and strong adherence to the rule of law board reforms tend to impede innovation. In contrast, in developing countries, with a weaker adherence to the rule of law and high levels of corruption, board reforms may tend to accelerate firm innovation output.

Given that innovation accounts for approximately half of total GDP growth (OECD, 2015), we show that developing countries may benefit from board reforms as they enhance the quality and quantity of innovation. However, our results also caution against one-size-fits-all approaches in corporate board reforms. Reforms that align the CEO interests with the long-term viability of the firm and also remedy some of the negative effects of national structures will tend to enhance firm innovation. However, reforms that induce managerial short-termism and tend to disrupt the innovation ecosystem will have negative effects in stimulating long-term growth.

## Appendix A. Major board reforms

| Country | Year | Board Independence | CEO-Chairman Duality | Audit Committee | Approach |
|---|---|---|---|---|---|
| Australia | 2004 | 1 | 1 | 1 | Comply-or-explain |
| Austria | 2004 | 1 | 0 | 1 | Comply-or-explain |
| Belgium | 2005 | 1 | 1 | 1 | Comply-or-explain |
| Brazil | 2002 | 0 | 0 | 0 | Rule-based |
| Canada | 2004 | 1 | 1 | 1 | Rule-based |
| China | 2001 | 1 | 0 | 1 | Rule-based |
| Colombia | 2001 | 0 | 0 | 0 | Rule-based |
| Denmark | 2001 | 1 | 0 | 0 | Comply-or-explain |
| France | 2003 | 0 | 0 | 1 | Rule-based |
| Germany | 2002 | 1 | 0 | 1 | Comply-or-explain |
| Greece | 2002 | 1 | 0 | 1 | Rule-based |
| India | 2002 | 1 | 0 | 1 | Rule-based |
| Indonesia | 2007 | 1 | 0 | 1 | Rule-based |
| Italy | 2006 | 1 | 0 | 1 | Rule-based |
| Japan | 2002 | 0 | 0 | 1 | Rule-based |
| Mexico | 2001 | 1 | 0 | 1 | Rule-based |
| Netherlands | 2004 | 1 | 1 | 1 | Comply-or-explain |
| Norway | 2005 | 1 | 1 | 1 | Comply-or-explain |
| Poland | 2002 | 1 | 0 | 0 | Comply-or-explain |
| South Korea | 1999 | 1 | 0 | 1 | Rule-based |
| Spain | 2006 | 1 | 0 | 1 | Comply-or-explain |
| Sweden | 2006 | 1 | 1 | 1 | Comply-or-explain |
| Switzerland | 2002 | 0 | 0 | 0 | Comply-or-explain |
| Thailand | 2002 | 1 | 0 | 1 | Comply-or-explain |
| Turkey | 2002 | 1 | 1 | 0 | Comply-or-explain |
| UK | 1998 | 1 | 1 | 1 | Comply-or-explain |
| US | 2003 | 1 | 0 | 1 | Rule-based |

Note: This table contains detailed information of major board reforms across 27 countries. It includes the year of the reform, the component (i.e., board independence, the separation of CEO and chairman, and audit committee and independence) the reform involves, and the approaches adopted by the authorities to implement the reform. "Rule-based" means the reforms are mandatory regulatory requirements; "Comply-or-explain" means the reforms are generally regulatory recommendations.

## Appendix B. Variable definitions

| Variable | Definition |
|---|---|
| **Dependent variables** | |
| $Pat\_num_{t+1}$ | The natural logarithm of patents number of companies applied in one year forward plus 1. |
| $Pat\_cite_{t+1}$ | The natural logarithm of patents non-self-citations in one year forward plus 1. |
| R&D | Equal to change in R&D divided by lagged total assets. |
| **Independent variables** | |
| Post | The dummy variable equals to one since a country in a certain year adopts a major board-related reform for the first time, otherwise zero. |
| Post_Board_Independence | A dummy variable equals to one since a country in a certain year enforces the board reform that focuses on board independence, otherwise zero. |
| Post_CEO_Chairman_Duality | A dummy variable equals to one since a country in a certain year enforces the board reform that focuses on CEO and chairman duality, otherwise zero. |
| Post_audit_Committee | A dummy variable equals to one since a country in a certain year enforces the board reform that focuses on audit committee independence, otherwise zero. |
| **Control variables** | |
| Firm_size | The natural logarithm of total assets (U.S. dollar) of a firm. |
| Leverage | The ratio of total debt over total asset of a firm. |
| Cash | The ratio of cash equivalent over total asset of a firm. |
| MTB | The market value scale book value. |
| WDI_GDP | The natural logarithm of real Gross Domestic Product measured in 2010 U.S. dollar. |
| WDI_capita | The natural logarithm of real GDP per capita measured in 2010 U.S. dollar. |

## Appendix C. Variable correlation matrix

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $Pat\_num_{t+1}$ | (1) | 1.000 | | | | | | | | | | | | |
| $Pat\_cite_{t+1}$ | (2) | 0.893*** | 1.000 | | | | | | | | | | | |
| R&D | (3) | 0.017*** | 0.029*** | 1.000 | | | | | | | | | | |
| Post | (4) | 0.017*** | -0.011** | -0.016*** | 1.000 | | | | | | | | | |
| Firm_size | (5) | 0.376*** | 0.255*** | -0.035*** | -0.014*** | 1.000 | | | | | | | | |
| Leverage | (6) | 0.024*** | -0.010** | -0.046*** | -0.125*** | 0.321*** | 1.000 | | | | | | | |
| Cash | (7) | -0.027*** | 0.008* | 0.037*** | 0.086*** | -0.265*** | -0.389*** | 1.000 | | | | | | |
| MTB | (8) | 0.025*** | 0.075*** | 0.066*** | -0.005 | -0.258*** | -0.041*** | 0.216*** | 1.000 | | | | | |
| WDI_GDP | (9) | 0.041*** | 0.126*** | 0.002 | -0.005 | -0.221*** | -0.114*** | 0.120*** | 0.117*** | 1.000 | | | | |
| WDI_capita | (10) | -0.064*** | 0.048*** | 0.003 | 0.108*** | -0.173*** | -0.057*** | 0.056*** | -0.008* | 0.269*** | 1.000 | | | |
| Rule_of_law | (11) | -0.111*** | -0.002 | -0.001 | -0.103*** | -0.025*** | 0.019*** | -0.055*** | -0.069*** | -0.009* | 0.708*** | 1.000 | | |
| Corruption | (12) | -0.078*** | 0.044*** | -0.004 | -0.152*** | -0.184*** | -0.039*** | 0.023*** | -0.028*** | 0.235*** | 0.728*** | 0.681*** | 1.000 | |
| Emerging_market | (13) | 0.064*** | -0.055*** | 0.003 | 0.158*** | 0.166*** | 0.035*** | -0.032*** | 0.022*** | -0.282*** | -0.747*** | -0.656*** | -0.963*** | 1.000 |

Note: This table presents the correlation matrix of the variables used in our research. The Appendix B contains all variable definitions.

## Appendix D. R&D variable included

| Dependent Variable | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ |
|---|---|---|
| | (1) | (2) |
| Post | -0.207*** | -0.132*** |
| | (-3.51) | (-3.89) |
| R&D | 0.090 | 0.273** |
| | (0.93) | (2.52) |
| Post*R&D | 0.111* | 0.027 |
| | (1.98) | (0.33) |
| Firm_size | 0.470*** | 0.500*** |
| | (7.20) | (8.89) |
| Leverage | -0.852*** | -0.911*** |
| | (-6.57) | (-3.21) |
| Cash | 0.571*** | 0.774*** |
| | (6.08) | (7.73) |
| MTB | 0.048*** | 0.060*** |
| | (8.62) | (11.67) |
| WDI_GDP | -3.022** | -1.956** |
| | (-2.28) | (-2.74) |
| WDI_capita | 0.772** | 0.753*** |
| | (2.45) | (3.32) |
| Observations | 50,754 | 50,754 |
| R-squared | 0.397 | 0.360 |
| Country FE | Yes | Yes |
| Industry FE | Yes | Yes |
| Year FE | Yes | Yes |

Note: We performed preliminary tests with the R&D variable included and found that its incremental effect is statistically significant and consistent with theoretical expectations. Incorporating R&D independently in the model will strengthen the robustness and clarity of our results.

## Table 2.1 Summary statistics

| Panel A: Sample distribution | | | |
|---|---|---|---|
| Country | Number of firms | Percentage | Cumulative percentage |
| Australia | 595 | 0.01 | 0.01 |
| Austria | 144 | 0 | 0.01 |
| Belgium | 273 | 0.01 | 0.02 |
| Brazil | 28 | 0 | 0.02 |
| Canada | 2035 | 0.04 | 0.06 |
| China | 1447 | 0.03 | 0.09 |
| Colombia | 1 | 0 | 0.09 |
| Denmark | 27 | 0 | 0.09 |
| France | 1579 | 0.03 | 0.12 |
| Germany | 1158 | 0.02 | 0.14 |
| Greece | 17 | 0 | 0.14 |
| India | 239 | 0 | 0.15 |
| Indonesia | 5 | 0 | 0.15 |
| Italy | 299 | 0.01 | 0.15 |
| Japan | 17636 | 0.35 | 0.5 |
| Mexico | 45 | 0 | 0.5 |
| Netherlands | 207 | 0 | 0.51 |
| Norway | 3 | 0 | 0.51 |
| Poland | 215 | 0 | 0.51 |
| South Korea | 1368 | 0.03 | 0.54 |
| Spain | 228 | 0 | 0.54 |
| Sweden | 449 | 0.01 | 0.55 |
| Switzerland | 91 | 0 | 0.55 |
| Thailand | 38 | 0 | 0.55 |
| Turkey | 8 | 0 | 0.55 |
| UK | 1566 | 0.03 | 0.59 |
| US | 21053 | 0.41 | 1 |

| Panel B: Sample descriptive | | | | | |
|---|---|---|---|---|---|
| | N | Mean | SD | Min | Max |
| $Pat\_num_{t+1}$ | 50,754 | 1.218 | 1.552 | 0.000 | 8.688 |
| $Pat\_cite_{t+1}$ | 50,754 | 1.157 | 1.681 | 0.000 | 9.432 |
| R&D | 50,754 | 0.006 | 0.074 | -6.059 | 3.779 |
| Firm_size | 50,754 | 8.083 | 3.295 | 1.652 | 15.359 |
| Leverage | 50,754 | 0.181 | 0.165 | 0.000 | 0.677 |
| Cash | 50,754 | 0.155 | 0.146 | 0.003 | 0.871 |
| MTB | 50,754 | 2.613 | 3.03 | 0.297 | 32.909 |
| WDI_GDP | 50,754 | 29.47 | 0.872 | 26.525 | 30.419 |
| WDI_capita | 50,754 | 10.51 | 0.443 | 7.361 | 11.043 |

Note: Panel A shows the sample distribution by country from year 1990 to 2015. Panel B contains the summary statistics of the dependent and independent variables in the regression analysis. All variables are defined in Appendix B.

**Table 2.2 Major Board reform and innovation**

| Dependent Variable | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ | R&D | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Post | -0.205*** | -0.130*** | 0.007** | -0.207*** | -0.132*** |
| | (-3.49) | (-3.83) | (2.54) | (-3.51) | (-3.87) |
| Post*R&D | | | | 0.201** | 0.299*** |
| | | | | (2.08) | (3.64) |
| Firm_size | 0.470*** | 0.501*** | 0.001** | 0.470*** | 0.501*** |
| | (7.21) | (8.90) | (2.29) | (7.20) | (8.90) |
| Leverage | -0.855*** | -0.916*** | -0.017** | -0.853*** | -0.913*** |
| | (-6.61) | (-3.22) | (-2.28) | (-6.59) | (-3.22) |
| Cash | 0.572*** | 0.776*** | 0.007 | 0.571*** | 0.774*** |
| | (6.07) | (7.74) | (1.23) | (6.08) | (7.73) |
| MTB | 0.048*** | 0.060*** | 0.001*** | 0.048*** | 0.060*** |
| | (8.59) | (11.66) | (8.47) | (8.61) | (11.67) |
| WDI_GDP | -3.020** | -1.954** | 0.008 | -3.022** | -1.957** |
| | (-2.27) | (-2.73) | (0.59) | (-2.28) | (-2.74) |
| WDI_capita | 0.772** | 0.754*** | 0.002 | 0.771** | 0.752*** |
| | (2.44) | (3.30) | (0.26) | (2.44) | (3.32) |
| Observations | 50,754 | 50,754 | 50,754 | 50,754 | 50,754 |
| R-squared | 0.397 | 0.360 | 0.018 | 0.397 | 0.360 |
| Country FE | Y | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y |

Note: This table presents the effect of the major board reform on firm innovation. We first run regression to full sample. Then we test the moderation effect of R&D on patent counts and citations after board reforms. We include industry fixed effect, country fixed effect and year fixed effect in all Columns. All variables are defined in Appendix B. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10% respectively.

## Table 2.3 Dynamic effect

| Dependent Variable | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ | R&D | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Year 2 and 2- before board reforms | 0.061 | 0.125 | 0.001 | 0.062 | 0.125 |
| | (0.66) | (1.67) | (0.18) | (0.68) | (1.67) |
| Year of board reform | -0.167*** | -0.086*** | 0.006** | -0.168*** | -0.086*** |
| | (-2.94) | (-2.85) | (2.07) | (-2.96) | (-2.85) |
| Year 1 after board reform | -0.304** | -0.188** | 0.012* | -0.306** | -0.188** |
| | (-2.26) | (-2.42) | (2.03) | (-2.28) | (-2.42) |
| Year 2 and 2+ after board reform | -0.488* | -0.300** | 0.009* | -0.490* | -0.300** |
| | (-2.04) | (-2.19) | (1.76) | (-2.05) | (-2.19) |
| Post*R&D | | | | 0.205** | 0.303*** |
| | | | | (2.07) | (3.55) |
| Firm_size | 0.471*** | 0.501*** | 0.001** | 0.471*** | 0.501*** |
| | (7.19) | (8.89) | (2.28) | (7.19) | (8.89) |
| Leverage | -0.857*** | -0.915*** | -0.017** | -0.855*** | -0.915*** |
| | (-6.67) | (-3.23) | (-2.28) | (-6.65) | (-3.23) |
| Cash | 0.572*** | 0.774*** | 0.007 | 0.571*** | 0.774*** |
| | (6.09) | (7.76) | (1.25) | (6.10) | (7.76) |
| MTB | 0.048*** | 0.060*** | 0.001*** | 0.048*** | 0.060*** |
| | (8.67) | (11.74) | (8.54) | (8.69) | (11.74) |
| WDI_GDP | -2.879** | -1.892*** | 0.005 | -2.881** | -1.892*** |
| | (-2.29) | (-2.82) | (0.33) | (-2.30) | (-2.82) |
| WDI_capita | 0.757** | 0.755*** | 0.003 | 0.756** | 0.755*** |
| | (2.41) | (3.34) | (0.34) | (2.41) | (3.34) |
| Observations | 50,754 | 50,754 | 50,754 | 50,754 | 50,754 |
| Adjusted R-squared | 0.397 | 0.361 | 0.018 | 0.397 | 0.361 |
| Industry FE | Y | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y |

Note: This table presents the dynamic test of board reforms on innovation. We include industry fixed effect, country fixed effect and year fixed effect in all Columns. All variables are defined in Appendix B. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10% respectively.

**Table 2.4 Board reforms approach**

| Dependent Variable | $Pat\_num_{t+1}$ | $Pat\_cite_{t+1}$ |
|---|---|---|
| | (1) | (2) |
| Post | -0.222*** | -0.149*** |
| | (-3.29) | (-3.33) |
| Post*R&D | 0.200** | 0.298*** |
| | (2.09) | (3.65) |
| Post*comply | 0.124 | 0.129 |
| | (0.61) | (0.69) |
| Observations | 50754 | 50754 |
| Adjusted R-squared | 0.397 | 0.360 |
| Controls | Y | Y |
| Industry FE | Y | Y |
| Country FE | Y | Y |
| Year FE | Y | Y |

Note: This table presents the effect of the major board reforms on firm innovation in countries adopting different rule types. We use interactive variable to examine the influence of different approach. Control variables include $Firm\ size$, $Leverage$, $Cash$, $MTB$, $WDI\_GDP$ and $WDI\_capita$. All variables are defined in Appendix B. We include industry fixed effect, country fixed effect and year fixed effect. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10% respectively.

**Table 2.5 Board reforms under different external governance conditions**

| Panel A: Rule of Law | | | | |
|---|---|---|---|---|
| Dependent Variable | $Pat\_num_{t+1}$ | | $Pat\_cite_{t+1}$ | |
| | Low RoL | High RoL | Low RoL | High RoL |
| | (1) | (2) | (3) | (4) |
| Post | 0.758 | -0.189*** | 0.222 | -0.137*** |
| | (2.09) | (-2.84) | (0.51) | (-3.24) |
| Post*R&D | 11.426*** | 0.176** | 13.202*** | 0.268*** |
| | (7.76) | (2.11) | (9.42) | (3.94) |
| Observations | 1,526 | 49,228 | 1,526 | 49,228 |
| Adjusted R-squared | 0.437 | 0.396 | 0.408 | 0.363 |
| Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |
| Panel B: Corruption | | | | |
| Dependent Variable | $Pat\_num_{t+1}$ | | $Pat\_cite_{t+1}$ | |
| | Low corruption | High corruption | Low corruption | High corruption |
| | (1) | (2) | (3) | (4) |
| Post | -0.168** | 2.699** | -0.128** | 2.286* |
| | (-2.55) | (3.34) | (-2.85) | (2.14) |
| Post*R&D | 0.157** | 3.863* | 0.259*** | 4.388 |
| | (2.19) | (2.23) | (3.87) | (1.65) |
| Observations | 47575 | 3179 | 47575 | 3179 |
| Adjusted R-squared | 0.401 | 0.395 | 0.364 | 0.339 |
| Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |
| Panel C: Different Market | | | | |
| Dependent Variable | $Pat\_num_{t+1}$ | | $Pat\_cite_{t+1}$ | |
| | Emerging economies | Developed economies | Emerging economies | Developed economies |
| | (1) | (2) | (3) | (4) |
| Post | -0.281 | -0.164** | 0.059 | -0.127** |
| | (-1.80) | (-2.45) | (0.25) | (-2.72) |
| Post*R&D | 3.923** | 0.155** | 4.392 | 0.258*** |
| | (2.37) | (2.18) | (1.75) | (3.83) |
| Observations | 3,411 | 47,343 | 3,411 | 47,343 |
| Adjusted R-squared | 0.411 | 0.401 | 0.341 | 0.364 |
| Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |

Note: Panel A presents the effect of the major board reforms on firm innovation in different Rule of Low. Panel B presents the effect of the major board reforms on firm innovation in different country corruption. Panel C presents the effect of the major board reforms in firm innovation in different market. Control variables include $Firm\ size$, $Leverage$, $Cash$, $MTB$, $WDI\_GDP$ and $WDI\_capita$. All variables are defined in Appendix B. We include industry fixed effect, country fixed effect and year fixed effect in all panel. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10%.

**Table 2.6 Board reforms with different component**

| Dependent Variable | $Pat\_num_{t+1}$ | | | $Pat\_cite_{t+1}$ | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Post_Board_Independence | -0.155** | | | -0.099 | | |
| | (-2.63) | | | (-1.49) | | |
| Post_CEO_Chairman_Duality | | 0.026 | | | -0.026 | |
| | | (0.17) | | | (-0.21) | |
| Post_audit_Committee | | | -0.203*** | | | -0.135*** |
| | | | (-3.54) | | | (-4.04) |
| Post*R&D | 0.200** | 0.193** | 0.201** | 0.299*** | 0.294*** | 0.299*** |
| | (2.10) | (2.15) | (2.08) | (3.64) | (3.73) | (3.64) |
| Observations | 50,754 | 50,754 | 50,754 | 50,754 | 50,754 | 50,754 |
| Adjusted R-squared | 0.397 | 0.396 | 0.397 | 0.360 | 0.360 | 0.360 |
| Controls | Y | Y | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y |

Note: This table presents the differential effect of different component in the major board reform on firm innovation. We test board reforms with three different components: Board independence, separate of CEO and Chairman and audit committee independence. $Post\_Board\_Independence$ equal to one if major board reforms require board independence, otherwise zero. $Post\_CEO\_Chairman\_Duality$ equal to one if major board reforms require separate CEO and Chairman duality, otherwise zero. $Post\_audit\_Committee$ equal to one if major board reforms require audit committee independence, otherwise zero. Control variables include $Firm\ size$, $Leverage$, $Cash$, $MTB$, $WDI\_GDP$ and $WDI\_capita$. All variables are defined in Appendix B. We include industry fixed effect, country fixed effect and year fixed effect in all Panel. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10% respectively.

**Table 2.7 Subsample test**

| Dependent Variable | $Pat\_num_{t+1}$ | | $Pat\_cite_{t+1}$ | |
|---|---|---|---|---|
| | Excluding USA | Excluding Japan | Excluding USA | Excluding Japan |
| | (1) | (2) | (3) | (4) |
| Post | -0.216*** | -0.125*** | -0.160*** | -0.130** |
| | (-4.03) | (-2.70) | (-2.87) | (-2.56) |
| Post*R&D | 0.494*** | 0.144* | 0.439** | 0.232** |
| | (2.95) | (1.77) | (2.48) | (2.13) |
| Observations | 29,701 | 33,118 | 29,701 | 33,118 |
| Adjusted R-squared | 0.416 | 0.377 | 0.384 | 0.342 |
| Controls | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y |

Note: This table presents the result of the robustness test. First, we elusive USA innovation data which occupy 41 percent of our sample. We are then exclusive Japan innovation data which occupy 34 percent of our sample. Control variables include $Firm\ size$, $Leverage$, $Cash$, $MTB$, $WDI\_GDP$ and $WDI\_capita$. All variables are defined in Appendix B. We include industry fixed effect, country fixed effect and year fixed effect. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the firm level. ***, **, * denote significance levels at 1%, 5% and 10% respectively.

**Table 2.8 Long time shock test**

| Dependent Variable | Patent number | | | | Patent citation | | | |
|---|---|---|---|---|---|---|---|---|
| | Year 2 | Year 3 | Year 4 | Year 5 | Year 2 | Year 3 | Year 4 | Year 5 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Post | -0.208*** | -0.226** | -0.325*** | -0.370** | -0.124** | -0.132** | -0.175** | -0.138 |
| | (-2.96) | (-2.72) | (-3.13) | (-2.56) | (-2.75) | (-2.66) | (-2.16) | (-1.54) |
| Post*R&D | 0.274*** | 0.286** | 0.178*** | 0.134** | 0.342*** | 0.281*** | 0.211** | 0.260*** |
| | (3.89) | (2.77) | (4.60) | (2.53) | (3.64) | (4.79) | (2.70) | (7.89) |
| Observations | 48,426 | 43,844 | 39,423 | 35,345 | 48,426 | 43,844 | 39,423 | 35,345 |
| Adjusted R-squared | 0.399 | 0.401 | 0.406 | 0.410 | 0.363 | 0.366 | 0.369 | 0.368 |
| Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| Industry FE | Y | Y | Y | Y | Y | Y | Y | Y |
| Country FE | Y | Y | Y | Y | Y | Y | Y | Y |
| Year FE | Y | Y | Y | Y | Y | Y | Y | Y |

Note: This table presents the long-time effect of board reforms on innovation. The dependent variable of $Patent\ number$ is the natural logarithm of patents number of companies applied in two (three, four or five) year lag plus 1. The dependent variable $Patent\ citation$ refer to the natural logarithm of patents non-self-citations in two (three, four or five) year lag plus 1. Control variables include $Firm\ size$, $Leverage$, $Cash$, $MTB$, $WDI\_GDP$ and $WDI\_capita$. All variables are defined in Appendix B. We include industry fixed effect, country fixed effect and year fixed effect. Robust t-statistics are reported in parenthesis, which are based on standard errors clustered at the country level. ***, **, * denote significance levels at 1%, 5% and 10%.

# Chapter 3: Hardship's Influence How Early Trauma Shapes CEO Risk Appetite for Debt

## 3.1 Introduction

"Living through a deadly typhoon showed me life's impermanence. I prioritize the present and take bold risks some may call reckless."

Carlos Ghosn, former Nissan CEO

Debt financing plays a pivotal role in funding corporate operations and growth, comprising nearly half of large U.S. firms' capital structure (DeAngelo and Roll, 2015). Understanding the factors that influence corporate debt structure is vital because debt financing provides the majority of external capital for most companies. Companies employ a diverse range of loan instruments and make significant adjustments to their debt mix over time (Rauh and Sufi, 2010). Public bonds and bank loans are two significant sources of debt. Despite being more expensive, bank debt provides advantages to companies with high levels of information asymmetry and limited access to public markets (Diamond, 1991; Krishnaswami et al. 1999). In contrast to diffuse public creditors who primarily depend on public disclosure, banks possess a comparative advantage in monitoring enterprises by virtue of their access to private data (Besanko and Kanatas, 1993). Moreover, diffuse bondholders face collective action problems in supervising firms compared to concentrated bank lenders (Datta et al. 1999; Houston and James, 1996). Recent empirical work increasingly recognizes variations in debt structure and the importance of analyzing differentiated debt choices (Bharath and Hertzel, 2019; Chen et al. 2020; Colla et al. 2013). For example, empirical studies show ownership, performance, asset opacity, significantly impact debt structure variation (Chen et al. 2020; Colla et al. 2013). This paper investigates the impact of CEOs' early disaster experiences on the composition of debt, addressing a significant void in the existing literature.

The Upper echelons theory, proposed by Hambrick and Mason in 1984, has given rise to a substantial body of literature that explores the influence of past experiences on the cognitive processes and values of managers. Consequently, this has implications for the behavior exhibited by the companies they lead (e.g., Bigley and Wiersema, 2002; Chin et al. 2013; Crossland et al. 2014; Finkelstein et al. 2009; Hambrick, 2007). Recently, researchers have expanded upon existing literature by highlighting the influential effects of experiences that occur during critical periods in the early stages of executives' life and build a link between the formative experiences of CEOs and their subsequent corporate policies. This connection has been observed in various contexts, such as military service (Benmelech and Frydman, 2015), pilot training (Sunder et al. 2017), the Great Depression (Malmendier et al. 2011), the Cultural Revolution (Kong et al. 2021), and natural disasters (Bernile et al. 2017). Recent studies have examined the effects of CEOs' early exposure to disasters on various aspects of corporate performance. O'Sullivan et al. (2021) have explored the implications for corporate social performance, while Chen et al. (2021) have focused on the impact on stock market crash risk. Additionally, Bernile et al. (2017) have investigated the relationship between childhood catastrophes and variables such as leverage and acquisitions, while Tian et al. (2023) have examined the influence on strategic risk taking. The aforementioned studies shed light on the impact of early trauma experienced by CEOs on their subsequent corporate decision-making. However, there is a dearth of research examining the precise implications of CEOs' early disaster experiences on debt structure. Debt composition is a major financial decision reflecting risk preferences and strategic priorities. Early trauma could distinctly shape CEO's preference on debt structure. Our objective is to fill this void by examining the influence of childhood disaster exposure on the debt financing.

We expect firms led by CEOs who endured childhood disasters use more public debt and less bank debt for several reasons. First, According to Bernile et al. (2017), CEOs with early early-

life disaster experiences commonly have a higher level of risk tolerance when making financial and investment decisions. Firms led by CEOs with early-life disaster experience might engage in acquisitions, utilize leverage, and pursue other strategies that could potentially elevate the risk of default. Banks will acknowledge this inclination and implement more stringent supervision in comparison to public debt markets. In contrast, the dispersed ownership of public bonds gives rise to a free rider dilemma, as individual creditors lack the motivation to bear the complete burden of monitoring costs (Diamond, 1984). Stringent oversight by banks can serve as a deterrent to excessive managerial risk-taking that poses a threat to solvency (Rajan, 1992; Stiglitz & Weiss, 1983). The implementation of rigorous bank monitoring has a significant effect on executives who are incentivized to take risks, as indicated by their early-life disaster experiences. As discussed, CEOs who endured childhood disasters are more willing to take risk, then may prefer autonomy and may attempt to evade examination (Armstrong and Vashishtha, 2012). The utilization of public debt instead of bank loans provides increased flexibility, as bondholders, who are dispersed, have obstacles in coordinating their actions.

Second, it has been observed that CEOs who have experienced early traumatic events tend to exhibit characteristics such as overconfidence and optimism biases (Malmendier et al. 2011). They may believe they can handle greater dangers without difficulty (Aldwin, 2009). However, banks will view irrational overconfidence as problematic and will seek to curb it through strict supervision. In light of these considerations, CEOs with a history of early-life natural disasters may exhibit a predisposition to lean more heavily on public debt rather than relying on bank debt. This strategic shift could be attributed to the banking sector's proactive measures to address and curb irrational overconfidence. The preference for public debt might stem from the perception that it offers a more regulated and scrutinized financial avenue, aligning with the cautious approach adopted by banks in response to the CEO's overconfidence tendencies.

Consequently, this nuanced approach to debt financing underscores the intricate interplay between personal experiences, psychological traits, and the financial decision-making processes of corporate leaders in the dynamic landscape of the business world.

Thirdly, the impact of disasters on individuals' perspectives, it's noteworthy that such calamities often evoke a heightened sense of mortality salience, compelling people to confront the transient nature of life. In response to this existential awareness, a prevailing view emerges—that individuals, cognizant of life's fragility, may adopt a paradigm wherein the prioritization of immediate returns takes precedence over long-term considerations. This cognitive shift towards favoring immediate gains aligns with a mindset driven by the imperative to seize opportunities in the present, driven by a keen awareness of life's inherent uncertainties. This inclination towards short-term focus, however, introduces a potential discord with the typically long-term orientation of financial institutions, particularly banks. Recognizing the misalignment between individual short-term priorities and the financial sector's emphasis on sustained, stable growth, banks are prompted to counterbalance this dynamic through rigorous monitoring measures. The implementation of robust oversight serves as a mechanism to mitigate the risks associated with the divergence in temporal perspectives, ensuring that CEOs, influenced by their experiences of life's fragility, are held accountable for decisions that may prioritize immediate gains. In light of this intricate interplay between personal cognitive shifts and institutional responses, CEOs, perhaps influenced by a preference for immediate returns in the aftermath of disasters, may find a proclivity towards public debt.

Based on these reasons, CEOs who have experienced significant adversities throughout their formative years frequently cultivate values, mindsets, and personalities that are inclined to take extra risk and resistant to external constraints. Public debt is more conducive to accommodating these inclinations compared to the strict oversight of bank monitoring. Accordingly, we hypothesize that firms led by CEOs who endured early-life disasters rely more on public debt

and rely less on bank debt. To test our hypothesis, we use a sample of CEOs who were born in the United States and manually collected their biographical data, such as birth dates, birth cities, law educational backgrounds, and other information we used in the paper. Then, by merging CEO information with a comprehensive database of United States county-level natural disaster events, we can distinguish between CEOs who experienced natural disasters in their formative years (i.e., ages 5 to 15) and those who did not (Bernile et al. 2017). Following Lin et al. (2013), we calculate the firm debt composition using the bank debt to total debt ratio and the public debt to total debt ratio. We find that firms led by CEOs with early-life disaster experience rely more on public debt and less on bank debt.

To mitigate endogeneity concerns and provide a more causal interpretation of our main finding, we adopt four identification tests to establish a causal relation between CEOs early-life disaster experience and debt structure: (1) propensity score matching (PSM), (2) entropy balancing matching (EB), (3) difference-in-difference (DID) test utilizing CEO with exogenous and force turnover event, and (4) placebo test. The negative (positive) relation between CEOs early-life disaster experience and bank (public) debt remains robust in all four identification tests, supporting a causal interpretation of our finding. Although our identification tests cannot fully correct for the endogeneity bias, these tests reduce the likelihood that our main finding is driven by endogenous matching or omitted variables.

Moving on from our identification tests, we next conduct cross-sectional analyses to better understand the potential channels through which CEOs early-life disaster experience are related to debt structure. We find that the negative association between CEOs early-life disaster experience and the bank debt (and positive relation with public debt) is more pronounced in certain settings. Specifically, the effects are stronger when regulatory oversight is stricter, as proxied by distance from SEC office locations. Tighter monitoring motivates risk-averse CEOs imprinted by disasters to avoid the tight governance of bank loans by shifting toward public

debt. Additionally, the relationship is magnified for firms headquartered in states with generous unemployment insurance benefits. With greater income protection, imprinted CEOs can more easily implement their tendency for risk-taking through adjustable public debt. Finally, firms facing higher financial distress risk, measured by Ohlson's O-score (Ohlson, 1980), display greater sensitivity. Public debt's relatively easier renegotiation during potential trouble likely appeals to CEOs imprinted by adversity. Collectively, these contingent analyses indicate childhood adversity exposure tends to shift debt structure away from bank loans and toward public debt issuance when regulatory supervision is stronger, unemployment benefits are more generous, and financial constraints are greater. The amplified effects in these setting further illuminate the mechanisms through which CEO formative trauma influences debt financing decisions. By exploring settings that strengthen the relationships, we gain additional insights into the channels linking CEO early experiences to altered debt structure preferences.

Our core results are robust across a battery of sensitivity tests, supporting the reliability of the findings. For starters, the evidence is robust when we add CEO birth-year and growth-place at city level fixed effects to eliminate any potential cohort-related effects (O'Sullivan et al. 2021). Also, we conduct subsample tests that remove firms headquartered in New York, Pennsylvania, and Ohio - the states contributing the most observations and our main findings still hold. Additionally, the evidence is robust to directly controlling for CEOs' equity incentives, age, tenure, gender and legal background. Finally, our main results persist when use an alternative measure of early trauma based solely on childhood exposure from ages 5-10. The consistent results across these stringent checks provide assurance that the links between CEO early disaster experience and debt structure are not contingent on model specifications or specific subsamples.

We make three major contributions to prior work. First, we advance recent research on on how executive background experiences shape corporate policies and performance. While prior

studies reveal CEO military service, recession exposure, and other background factors influence decisions, we report the first evidence on the link between the CEO early disaster experience and debt structure.[12] Given debt composition is a major corporate financing policy that directly reflects a CEO's risk tolerance and strategic priorities, these findings significantly expand the upper echelons perspective. Second, we complement extensive work on firm and country determinants of debt structure by introducing CEO early trauma as an important individual-level driver. Previous studies have focused on how firm-level and country-level characteristics affect a firm's debt structure (e.g., Ben-Nasr., 2019; Ben-Nasr et al. 2021; Lin et al. 2013). At the manager level, Chen et al. (2020) show that CEOs' risk-taking incentives in executive pay reduce the reliance on bank debt. We push this strand of research forward by showing that it is important to consider CEOs' formative experience when explaining the cross-sectional variations of debt structure among US public firms. This adds a new human lens to our understanding of capital structure decisions. Finally, we contribute to the nascent but growing stream of research on how CEOs' early-life exposure to disasters impacts corporate policies, including acquisitions, cash holdings, and crash risk (Bernile et al. 2017; O'Sullivan et al. 2021). By documenting sizeable effects on debt decisions, we bolster the fundamental impact of childhood events on executive-level decision-making. In general, this study contributes to the existing body of academic research by providing a more comprehensive understanding of the factors that influence debt structure and the resulting consequences.

[12] In a study examining different research questions, Bernile et al. (2017) show that CEOs with early-life disaster experience impact firm acquisitions, leverage, cash holdings, and stock returns. Additionally, O'Sullivan et al. (2021) find that CEOs with early-life disaster experience would shoulder more responsibility for the firm. Moreover, Chen et al. (2021) document that firms led by CEOs with early-life disaster experience have higher stock price crash risk.

Additionally, it sheds light on the significant influence that CEO background has on strategic decision-making.

The chapter proceeds as follows. Section 3.2 document the literature review and discuss the hypothesis of the study. Section 3.3 discusses the sample selection, measurement of key variables and the descriptive statistics. Section 3.4 presents main empirical results, supplementary analyses and robustness checks. Section 3.5 concludes the paper.

**3.2 Literature review and hypothesis development**

Debt structure refers to the type, terms, and maturity of debt that a company or government uses to finance its operations. The debt structure of an organization can have a significant impact on its financial stability, creditworthiness, and ability to access capital in the future. One important aspect of debt structure is the mix of short-term and long-term debt. Short-term debt, such as bank loans and commercial paper, must be repaid within one year, while long-term debt, such as bonds, has a maturity of more than one year. A company that relies heavily on short-term debt may be at a higher risk of default, as it must continually rollover or refinance its debt, while a company with a higher proportion of long-term debt may be at a lower risk of default but may face higher interest payments. Another important aspect of debt structure is the mix of secured and unsecured debt. Secured debt is backed by collateral, such as property or equipment, while unsecured debt is not. Unsecured debt is considered riskier than secured debt, as it has no collateral to back it up, and thus, unsecured creditors have a lower priority in the event of a default.

Public debt is a type of bond in which companies normally agree to pay predetermined coupon payments over the bond's life and the par value when it matures. The bond is sold to a large number of passive investors who are not interested to keep track of the loan (Diamond, 1991). Because public debt is unmonitored, companies borrowing in this market are anticipated to be among the biggest and most trustworthy players in the credit market (Houston and James, 1996;

Gomes and Phillips, 2012). Bank loans are typically referred to as bilateral agreements wherein interest and principal are repaid during the period of the loan. Because the agreement is between a single party, it can be more closely monitored and negotiated. Diamond (1991) described how businesses looking to establish a partnership with a bank can borrow from a bilateral agreement. To maintain a competitive advantage, businesses will also select a single lender when they are worried that rivals will obtain confidential information (Bushman et al. 2010).

The debt structure of a company can also have an impact on its creditworthiness. A company with a high debt-to-equity ratio, indicating a high level of debt relative to its assets, may be seen as a higher risk by creditors and investors. Additionally, a company with a high proportion of junk bonds, which are bonds rated below investment grade, may be seen as a higher risk. Corporate finance theories claim that banks outperform other types of lenders in terms of monitoring effectiveness (Boyd and Prescott, 1986; Berlin and Loyes, 1988). This benefit derives from three reasons. First, compared to other types of lenders, banks have cheaper access to private information, allowing them to more closely monitor business insiders' behavior and spot expropriation activities (Fama, 1985). Second, bank lenders have much more concentrated ownership of debt claims as compared to public debtholders. Thus, banks are likely to face fewer free-rider problems and avoid the wasteful duplication of monitoring (Diamond, 1984; Houston and James, 1996). Third, bank lenders have a better capacity to penalize borrowing companies by liquidating them or renegotiating the contract of the loan (Gertner and Scharfstein, 1991; Chemmanur and Fulghieri, 1994). Moral hazard problems are diminished by increasing influence and pressure on corporate insiders via the power of this oversight (Rajan, 1992; Park, 2000).

Previous research revealed that a number of circumstances have an effect on debt structures. For example, Chen et al. (2020) found that firms that have fewer redeployable assets—which can be measured as the capacity to renegotiate bank debt agreements—are more likely to

borrow from banks rather than issue public debt. Bank debt financing can be recognised as complementary to corporate governance, in which firms with effective corporate governance will decrease bank debt (Ben-Nasr et al. 2021). Additionally, when collateral values rise, firms could favour bank debt over public debt (Lin, 2016). The value of the borrower's underlying assets and projects can be better understood by delegated monitoring banks. When a borrower defaults, this greater monitoring enables banks to make somewhat more effective liquidation decisions, and firms with more valuable collateral gain more from effective liquidation decisions (Berlin and Loeys, 1988; Park, 2000). Lin et al. (2013) found that companies managed by large shareholders with excessive control rights may prefer public debt financing to bank debt as a strategy to shield themselves from monitoring. Tan et al. (2020) documented that greater CSR disclosure by borrowing firms results in cheaper bond issuance costs and an incentive to borrow from public lenders, leading them to rely more on public debt than on private debt.

The theory of the upper echelons (Hambrick and Mason, 1984) contends that earlier experiences have a lasting impact on a firm's top executives' cognition and values, which influence a firm's behaviour (Bertrand and Schoar, 2003). Based on the upper echelons theory, a growing body of studies focused on the effects of early encounters in executives' careers (Jung and Shin, 2019; Marquis and Qiao, 2020). Additionally, a wealth of psychological literature points to early life as the primary source of imprints that shape cognition and behaviour in adulthood (Elder, 2018; Mannheim, 1970). The impact of early-life disaster experiences on individuals can extend far beyond childhood and adolescence, and can also affect individuals in leadership positions, such as CEOs. For example, O'Sullivan et al. (2021) found that CEOs who experience early-life disasters would be more reliant on others and would improve the corporate social performance of their companies. Chen et al. (2021) use a longitudinal sample of U.S. companies to show that firms with CEOs who have early-life

disaster experience are more likely to have stock price crashes. Stock price crashes occur because a CEO with early-life disaster experience is more risk tolerant and hence more likely to take the dangers connected with hoarding bad news, which leads to the risk of a stock price crash (Chen et al. 2021). Similarly, Bernile et al. (2017) found that those CEOs with "moderate" exposures to disaster-related fatalities are more likely to be tolerant of firm risk-taking: they are more likely to engage in acquisitions; their firms hold more debt and less cash as a percentage of assets, and their stock returns are more volatile.

Thus, early-life disaster experiences can impact an individual's decision-making and risk-taking behavior, which can have a significant effect on a company's debt structure. Existing theories on CEO early-life experience and corporate debt financing choice provide differing views on the relationship between CEO behaviour and the decision between bank debt and public debt. On the one hand, CEOs with early-life experience may prefer to issue public debt and reduce bank debt. Banks can more successfully supervise borrowing companies due to their access to inside information than bondholders, who must depend mostly on publicly available information (Dass and Massa, 2011; Fama, 1985). As a result, bank supervision is more likely to prevent managers from taking excessive risks that may jeopardise business solvency (Rajan, 1992). Moreover, the diffusion of public debt ownership creates a free-rider problem and inefficient duplication of monitoring effects, reducing bondholders' motivation to engage in costly monitoring (Datta et al. 1999; Houston and James, 1996). Banks, unlike bondholders, have considerable incentives to supervise the management of borrowing enterprises due to the concentrated ownership of loan claims. As previously stated, CEOs with early-life disaster experience encourage managers to participate in more aggressive risk-seeking behaviour, which raises the danger of financial problems (Bernile et al. 2017). Namely, banks are expected to tighten their oversight of borrowing firms controlled by riskier executives. Risk-loving CEOs may be tempted to move away from bank debt and toward public debt in

anticipation of severity monitoring. This bank monitor theory predicts that firms led by executives with high risk-loving tend to rely less on bank debt.

*H1a: CEO with early-life disaster experience will decrease bank debt and increase public debt.*

On the other hand, CEOs with early-life disaster experience result in risk-loving may increase bank debt. Firms led by risk-loving leaders increase their reliance on bank debt since renegotiating bank debt contracts in the event of financial distress is relatively straightforward and the conditions are less restrictive than public debt. For example, firms with a high bankruptcy risk tend to shift away from public debt and toward bank debt because banks are better able to renegotiate the contract or liquidate the firm in the event of bankruptcy (Denis and Mihov, 2003). More aggressive risk exposes a firm to the problem of being unable to repay its obligation under a debt contract. According to this viewpoint, the ease with which debt contracts can be restructured and renegotiated is a critical factor for executives adopting risky investment strategies (Morellec et al. 2015). The Trust Indenture Act of 1939 requires businesses to get the unanimous permission of public bondholders before changing any of the major elements of the bond indenture. Bondholders confront a collective-action dilemma in which scattered ownership and limited investments by individual bonds diminish incentives to collaborate (Detragiache, 1994). Thus, bank debt is simpler to renegotiate than public debt because of the lower dispersion (Gilson et al. 1990). The current regulatory framework provides banks with greater renegotiation flexibility than publicly owned debt, implying that it is preferable for borrowers with a higher ex-ante likelihood of financial problems to borrow bank debt. This renegotiation theory predicts that firms led by executives with high risk-loving tend to rely more on bank debt.

*H1b: CEO with early-life disaster experience will increase bank debt and decrease public debt.*

## 3.3 Data Description

### *3.3.1 Sample Selection and Data Sources*

Data on CEOs is gathered from a variety of sources, including Standard & Poor's (S&P) ExecuComp database, which encompasses companies in the S&P 500, S&P 400 mid-cap, and S&P 600 small-cap indices. The database includes most publicly traded American firms, as well as several medium and smaller enterprises. The ExecuComp database contains a broad range of corporate data and executive compensation information, which served as our primary source for CEO details. We gather information on CEOs' birthplace, birthyear, and other personal details from sources such as Bloomberg, NNDB, company websites, and online references, including Encyclopedia and Wikipedia pages. Where necessary, we utilize Google searches to obtain biographical information and double-check our data. We gather data on natural disasters from various sources, including the U.S. National Geophysical Data Center (NGDC), the U.S. Geological Survey (USGS), the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration, the U.S. National Climatic Data Center (NCDC), Spatial Hazard Events and Losses Database for the United States (SHELDUS™), and online resources (primarily Wikipedia). We gather information on the debt structure of companies from Standard & Poor's (S&P) Capital IQ's annual reports and financial data from Compustat North America's annual reports. Capital IQ offers comprehensive data on debt capital structure for more than 60,000 private and public firms globally, as well as equity capital structure data for over 80,000 operating and non-operating companies worldwide. The database encompasses debt attributes including security type, level of security, interest rate, date of maturity, type of interest, benchmark, secured status, convertible type, issued currency, benchmark spread, and additional features.

### *3.3.2 Debt Structure*

Capital IQ offers details on the overall debt and diverse forms of debt, including their respective values, for each of the sample companies. We differentiate each variety of debt based on its exclusive type identifier from Capital IQ. Commercial paper is labelled as an issued debt when the type identifier is one. Type identifier two denotes revolving credit, whereas type identifier three represents term loans. If the type ID is four and the level ID is one, the debt pertains to senior bonds and notes. However, if the type ID is four and the level ID exceeds one, it represents subordinated bonds and notes. On the other hand, if the type ID is five, then it corresponds to a capital lease. Type IDs six or seven are categorised as other debts. We eliminate duplicate debt data by employing unique identifiers for each debt issue, alongside the debt's amount and maturity, via Capital IQ. Based on previous research (Lin et al. 2013; Lou and Otto, 2020), the total debt is calculated by adding the various types of debt mentioned, such as term loans, revolving credit, senior and subordinated bonds, commercial paper, capital leases, and other debt. Bank debt is calculated by adding term loans and revolving credit. Meanwhile, public debt refers to the total amount of senior and subordinated bonds and notes. We do not consider commercial paper and capital leases in computing bank or public debt since it is uncertain whether they belong to private or public debt (Li et al. 2019). Our dependent variables are the bank debt ratio ($BANK$) and the public debt ratio ($PUBLIC$). We analyse the firm's trade-off between bank debt and public debt using the ratio of bank debt to total debt and public debt to total debt.

### *3.3.3 CEO Early-life Disaster Experience*

Following Bernile et al. (2017), we define chief executive officers (CEOs) with early-life disaster experience as those who faced a natural disaster between the ages of 5 and 15 during

their growth-up county[13]. We focus on this age range since it is critical in shaping long-lasting childhood memories and early adolescent development (Gathercole et al. 2004; Nelson, 1993). Our analysis of ExecuComp[14] data reveals the identification of 8,808 distinct CEOs from 1992 to 2020. Biographical data on each CEO is collected manually, including birthplace, birth year, growth place, legal education background, and other relevant information. This information is gathered from verified sources such as Bloomberg, NNDB, and company websites. As a result, we determined the precise childhood location of 1,839 CEOs. For the remaining CEOs lacking a confirmed childhood location, we follow the approach of Bernile et al. (2017) and use birthplace as a substitute. In conclusion, we were able to identify 2,072 CEOs with either a confirmed grow-up location or birthplace.

Next, we identify the disaster events that occurred in each CEO's county during their formative years. Consistent with previous studies (Bernile et al. 2017; Chen et al. 2021; O'Sullivan et al. 2021), we utilize natural hazards as a CEO's early-life disaster experience. These disaster events include earthquakes, volcanic eruptions, tsunamis, hurricanes, tornadoes, severe storms, floods, landslides, extreme temperatures, and wildfires. We retrieve disaster data from reliable sources such as the United States Geological Survey (USGS) and the National Geophysical Data Center (NGDC)[15], for essential earthquake and flood information. The NGDC website provides us with details on tsunamis. The National Climatic Data Center (NCDC) and the

[13] We identify the CEO's county of grow-up based on where they lived as children or where they attended high school.

[14] The ExecuComp database covers most public companies in the Standard & Poor's (S&P) 1500 index, including the S&P 500, S&P MidCap 400, and S&P SmallCap 600 indexes. We identify firm CEOs by using data items "CEOANN" in the ExecuComp database.

[15] See: https://www.ngdc.noaa.gov/ngdcinfo/onlineaccess.html

National Weather Service (NWS) of the National Oceanic and Atmospheric Administration[16] provide us with relevant data on hurricanes and tornadoes. For wildfires, we primarily rely on Wikipedia.[17] To ensure accuracy, we performed further the SHELDUS™ database and web searches for all disaster events. We established 1900 as the starting point for disaster research, as all CEOs were born after this year. The CEO's early-life disaster experience is measured as a binary variable. A dummy variable of 1 indicates that the CEO experienced at least one disaster during ages 5 to 15 in their grow-up county, and 0 is assigned if otherwise.

### *3.3.4 Control Variables*

In investigating the relation between CEO early-life disaster experience and debt structure, we control for differences in various firm characteristics including firm size ($SIZE$), leverage ($LEV$), asset tangibility ($TANGAB$), return on asset ($ROA$), Tobin Q ($Q$), Z score ($ZSCORE$), firms unrated dummy ($UNRATED$), and firms invest grade ($INV\_GRD$). We control for firm size ($SIZE$) by using the natural log of total assets, measured in millions of U.S. dollars, which may negatively impact bank debt (see Ben-Nasr et al. 2021). Leverage ($LEV$) is measured as the sum of long-term debt and debt in current liabilities divided by total assets, which should be negative to bank debt choice (see Ben-Nasr et al. 2021). We control asset tangibility ($TANGAB$) by using net property, plant, and equipment divided by total assets, which may be negative to bank debt choice. We control firm profitability by using return on assets ($ROA$), which is measured as earnings before interest and taxes ($EBIT$) divided by total assets. Tobin Q ($Q$) is the sum of the market value of equity plus the book value of debt divided by total assets, which may positively influence the choice of bank debt (see Ben-Nasr et al. 2019). The measurement of the Z score ($ZSCORE$) is described by Altman (1968). Additionally, we

[16] See: https://www.nhc.noaa.gov/data/

[17] See: https://en.wikipedia.org/wiki/List_of_wildfires

control the debt rate ($UNRATED$), which is an indicator equals to one if the firm without an S&P issuer credit rating. We further control firms invest grade ($INV\_GRD$), which is an indicator equals to one if the firm has above BBB- level reputation credit rating. Moreover, we control for year and industry (based on the SIC 2-digital industry code) in our analysis to eliminate potential differences and changes in the reliance on a particular debt type over time and across industries[18]. The details of the variables are shown in Appendix A.

### *3.3.5 Descriptive Statistics*

From this sample, we remove firms with missing financial data. Additionally, since financial and utilities firms' financial characteristics differ from those of firms in other industries (Chen et al. 2021), we also exclude financial firms (SIC codes 6000 to 6900) and regulated utilities (SIC codes 4900 to 4949). All variables in this study are winsorized at the 1 percent and 99 percent levels to avoid any potential problems with outliers. This selection procedure results in a final sample of 3564 firm-year observations covering 574 US-listed firms with 687 CEOs from 2002 to 2017[19]. In our sample, 80 CEOs had early-life disaster experience, a proportion of 11.64%.

Table 3.1 and Table 3.2 display relevant summary statistics and correlation coefficients. Table 3.1 shows that the mean value of $CEODIS$ amounts to 0.117, indicating that 11.7% of the firm-level observations within our sample have CEOs with early-life disaster experience, which is comparable to prior literature (Chen et al. 2021). The average bank debt ratio ($BANK$) is 0.349,

[18] It is important to note that corporate governance structures, particularly board characteristics such as diversity, may influence the relationship between CEOs with early-life disaster experiences and a firm's debt structure. These factors could play a significant role in shaping financial decisions. Future research should consider these variables to provide a slighter understanding of the CEO and debt choice relationship.

[19] Our data is from 2002 to 2017 because the Capital IQ database begins in 2002 and S&P rating data ends in 2017.

and the average public debt ratio ($PUBLIC$) is 0.545. Table 3.2 indicates the correlations between the variables. The data suggests that there is a significant negative correlation between the bank debt ratio ($BANK$) and CEO early-life disaster experience ($CEODIS$). Additionally, there is a significant positive correlation between the public debt ratio ($PUBLIC$) and CEO early-life disaster experience ($CEODIS$).

**[Insert Table 3.1 Here]**

**[Insert Table 3.2 Here]**

### *3.3.6 Research design*

To test whether the CEOs with early-life disaster experience are related to the firms' choice of borrowing from a bank or issuing public debt, we primarily estimate the following regression model:

$$Debt\ structure_{i,t} = \beta_0 + \beta_1 CEODIS_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 TANGAB_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Q_{i,t} + \beta_7 ZSCORE_{i,t} + \beta_8 UNRATED_{i,t} + \beta_9 INV\_GRD_{i,t} + \sum FE + \varepsilon_{i,t} \quad (1)$$

where $i$ denotes the firm, $t$ denotes the year, $\sum FE$ denotes industry fixed effects based on SIC 2-digital industry codes and year fixed effects, and $\varepsilon_{i,t}$ is the error term. We estimate the equation using ordinary least squares (OLS). Our standard errors are clustered at firm level. $Debt\ structure_{i,t}$ refers to bank debt ratio ($BANK$) or public debt ratio ($PUBLIC$). $CEODIS_{i,t}$ is our variable of interest and refers to CEO with early-life disaster experience or not. If the $Debt\ structure_{i,t}$ is the bank debt ratio ($BANK$) and the estimated coefficient $\beta_1$ is positive, which suggests that firms with CEO experience of early-life disasters are more likely to choose bank debt. Similarly, under the public bond ratio ($PUBLIC$) situation, if firms with CEO experience of early-life disasters are more likely to issue public bonds, then the estimated coefficient $\beta_1$ will be positive.

## 3.4 Results

### *3.4.1 Baseline Result*

In this section, we investigate the causal effect of CEO early-life disaster experience on firm debt choice. We estimate Eq. (1) with standard errors adjusted for firm clustering. In Table 3.3, we present the findings of baseline test estimation[20]. The estimate of the coefficient of the CEO with early-life disaster experience is shown in columns (1) and (2) of table 3.3. The result of column (1) shows that the coefficient of $CEODIS$ in the regression is negatively and statistically significant at the 5% level and the result of column (2) shows that the coefficient of $CEODIS$ in the regression is positively and statistically significant at the 1% level. The results suggesting that the debt structure of the firms led by CEOs with early-life disaster experience is more likely to issue public debt rather than borrow bank debt. One-standard-deviation increase in CEO with early-life disaster experience is associated with a 7.39% ($= -0.081 * 0.322/0.353$) decrease in the ratio of bank debt and a 4.79% ($= 0.081 * 0.322/0.544$) increase in the ratio of public debt. In addition, following prior studies (Chen et al. 2020; Lin et al. 2013), we add firm size ($SIZE$), leverage ($LEV$), asset tangibility ($TANGAB$), return on asset ($ROA$), and other firm characteristics as control variables. The results are displayed in columns (3) and (4) of table 3.3. The results remain the same: CEOs with early-life disaster experience significantly impact the firm's debt structure. The coefficients of columns (3) and (4) are -0.068 and 0.074, with t-statistics of -2.18 and 2.59, respectively. These results are also economically significant. For instance, column (3) coefficient of -0.068 on $CEODIS$ implies that one standard deviation increases in $CEODIS$ is associated with a 6.20% ($= -0.068 * 0.322/0.353$) decrease in bank debt ratio to the mean. Similarly, column (4)

[20] We have re-examined our test, lagging the independent and control variables by one year. The results remain consistent.

implies that one standard deviation increases in $CEODIS$ is associated with a 4.38% ($= 0.074 * 0.322/0.544$) increase in the public debt ratio. Moreover, the ratio of debt structure is cut off between 0 and 1, thus we applied the Tobit regression to confirm our results. The results are shown in columns (5) and (6) of table 3.3. The coefficients of columns (5) and (6) are -0.068 and 0.074, with t-statistics significant of 5% level and 1% level, respectively. The results still support our main conclusion that a CEO with early-life disaster experience will decrease bank debt and increase public debt.

**[Insert Table 3.3 Here]**

*3.4.2 Endogeneity Issues*

Our findings may be impacted by unobserved variables that affect the debt structure and the probability of a CEO with early-life disaster experience joining the target firm. To address this, we conduct matched sample testing. Initially, we use propensity score matching ($PSM$) to control for such concerns. Propensity score matching ($PSM$) generates a propensity score, indicating the probability of a unit with particular characteristics being allocated to the treatment group, as opposed to the control group. Through adjusting variables in the treated and control groups, these scores can be used to remove selection bias in observational research. To carry out our PSM analysis, we have determined that firms with CEOs who have early-life disaster experience as treatment group. Control group firms are those where the CEOs have not experienced any disasters in their early lives. To start with, under the PSM process, we conduct one-to-one matching through estimating propensity scores by using a logit approach.[21] The dependent variable is $CEODIS$ and the explanatory variables are the firm characteristics, including $SIZE$, $LEV$, $MB$, $TANGBPPE$, $ROA$, $Q$, $ZSCORE$, $RD$, $CASH$, $DIV$, $CAPX$, $UNRATED$, and $INV\_GRD$. We redo regression analysis by matching each firm led by a CEO

[21] We apply kernel matching, and the results remain the same.

with early-life disaster experience with another firm led by a CEO without early-life disaster experience through the closest matching score. The results in Panel A of Table 3.4 show that the differences between the treated and control groups are minimal across all variables. For instance, the size (*SIZE*) difference is only 0.057 with a t-statistic of 0.51, indicating no statistically significant difference between the groups post-matching. Similar patterns are observed for leverage (*LEV*), tangibility (*TANGAB*), return on assets (*ROA*), tobin Q (*Q)*, Z score (*ZSCORE)*, and the indicators for being unrated (*UNRATED*) or investment grade (*INV_GRD*). All t-statistics are below 2, suggesting that the matched control group closely mirrors the treated group in terms of these covariates. The findings presented in Panel B of Table 3.4 consistently indicate that firms led by a CEO with early-life disaster experience have reduced bank debt ratios and increased public debt ratios.

**[Insert Table 3.4 Here]**

We further applied entropy balancing to establish a causal connection between CEO with early-life disaster experience and firm debt structure. Entropy balancing is a method for matching treatment and control observations that comes from Hainmueller (2012). It constructs a set of matching weights by treatment group and control group characteristics. Similar to propensity score matching ($PSM$), we begin to estimate matching weights by firm characteristics ($SIZE$, $LEV$, $TANGB$, $ROA$, $Q$, $ZSCORE$, $RATED$, and $INV\_GRD$) in the treatment group (firms led by a CEO with early-life disaster experience) and control group (firms led by a CEO without early-life disaster experience)[22]. Then, we rerun regression with matching weights. The results of entropy balancing shown in Table 3.5 consistently demonstrate that firms led by a CEO with early-life disaster experience would significantly decrease the bank debt ratio while increasing the public debt ratio.

[22] Unlike PSM, entropy balancing reweights all the observations. This approach can mitigate sample limitations and further enhance the validity of our results.

**[Insert Table 3.5 Here]**

To further evaluate the causal impact of a CEO's early-life disaster experience on debt structure, we used CEO turnover events. The primary purpose of the turnover test is to establish a causal relationship between a CEO's early-life disaster experience and the company's debt structure. By observing changes in debt policies before and after a CEO transition, we can better infer whether these changes are attributable to the new CEO's characteristics, including their early-life experiences. CEO turnover events help control for confounding factors that could influence debt structure independently of the CEO's characteristics. For instance, market conditions, company performance, and industry trends might affect debt decisions. By focusing on periods around CEO transitions, we can more effectively isolate the impact of the CEO's personal experiences.

The CEO turnover events are identified based on CEO change in the ExecuComp database (Chen et al. 2021). Following a previous study (Eisfeldt and Kuhnen, 2013), if a different person held the position of CEO in the current year and the following year, we can determine when the CEO was replaced. We record this as a CEO turnover event for year t if the CEO's name in year $t$ and year $t+1$ are different. To test the CEO turnover events impact,[23] we applied the Difference-in-Differences (DiD) method. To conduct the test, we create a treatment group consisting of firms that experienced CEO turnover events with CEO change risk attitude (e.g., CEO without early-life disaster experience to CEO with early-life disaster experience). After applying these criteria, we identified 121 incidents of CEO turnover and 28 events where the firm's CEO risk attitude changed. Control firms are those firms that have not experienced CEO turnover events in the same period. We estimate DiD using the following regression model:

[23] We keep the firms with exogenous and force turnover events.

$$Debt\ structure_{i,t} = \beta_0 + \beta_1 CEODIS_{i,t} + \beta_2 TREAT_{i,t} + \beta_3 CEODIS * TREAT_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 TANGAB_{i,t} + \beta_7 ROA_{i,t} + \beta_8 Q_{i,t} + \beta_9 ZSCORE_{i,t} + \beta_{10} UNRATED_{i,t} + \beta_{11} INV\_GRD_{i,t} + \sum FE + \varepsilon_{i,t} \quad (2)$$

where $i$ denotes the firm, $t$ denotes the year, $\sum FE$ denotes industry fixed effects based on SIC 2-digital industry codes and year fixed effects, and $\varepsilon_{i,t}$ is the error term. Our standard errors are clustered at firm level. $Debt\ ratio_{i,t}$ refers to bank debt ratio ($BANK$) or public debt ratio ($PUBLIC$). $CEODIS_{i,t}$ is our variable of interest and refers to CEO with early-life disaster experience or not. $CEODIS * TREAT_{i,t}$ is the interactive variable that we are interested in, it is calculated by $CEODIS_{i,t}$ times $TREAT_{i,t}$. $TREAT_{i,t}$ is the index equal to 1 if a firm is the treatment group; otherwise, it is 0.

Notably, Table 3.6 results show that the coefficient estimate for the interaction term $CEODIS * TREAT_{i,t}$ is significant. The estimated coefficients are −0.055 and 0.141, with t-statistics of −2.05 and 3.72 for $BANK$ and $PUBLIC$, respectively. The result of column 1 suggests that the change in bank debt due to CEO risk attitude changes in firms is significantly negative from the pre-CEO turnover events to the post-CEO turnover events period. The result of column 2 suggests that the change in public debt of CEO risk attitude in changed firms is significantly positive from the pre-CEO turnover events to the post-CEO turnover events period. The DiD results support the bank monitor theory. As previously stated, CEOs with early-life disaster experience encourage managers to participate in more aggressive risk-seeking behaviour, which raises the danger of financial problems (Bernile et al. 2017). Therefore, banks are expected to strictly monitor these kinds of firms. In anticipation of severity monitoring, risk-loving CEOs can be enticed to shift away from bank debt and towards public debt. Thus, according to this bank monitor theory, firms run by leaders who enjoy taking on a lot of risks rely less on bank financing.

**[Insert Table 3.6 Here]**

### *3.4.3 Placebo Test*

In this section, a placebo test was used to determine the statistical significance of the observed effect. The purpose of such a test is to identify if the observed effect is either due to chance or if it holds true beyond random variation. In data analysis, one instance of placebo testing is the use of a null hypothesis in a t-test or ANOVA. The null hypothesis asserts that there is no difference between the control group and the treatment group or no disparity in the means of the groups being compared. The researcher performs a test and computes a p-value, representing the likelihood of observing an effect as large or greater than the one witnessed assuming the null hypothesis to be true. A p-value of below a certain threshold, commonly 0.05, leads to the null hypothesis' rejection and the effect's consideration as statistically substantial. For our study, we arbitrarily select a childhood growth location for every CEO in the sample, which aids in the inference of their early-life encounter with disasters. We generate a simulated variable, called $pseudo - CEODIS$, based on the randomly selected location of the CEO grow-up. This variable is implemented in lieu of an accurate measure of childhood disaster exposure throughout our analysis. We repeat this procedure 500 times to acquire 500 coefficient estimates for the correlation between $pseudo - CEODIS$ and debt structure. This allows us to determine an empirical distribution of the $pseudo - CEODIS$ coefficient, which is presented in Table 3.7. The findings demonstrate that true $CEODIS$ coefficient estimates are located at the far end of the empirical distribution of $pseudo - CEODIS$ coefficients, suggesting that the impact of early-life disaster experiences on debt structure is not coincidental.

**[Insert Table 3.7 Here]**

### *3.4.4 Cross-sectional tests*

In this section, we carry out cross-sectional analyses to gain a better comprehension of the potential mechanisms linking CEOs' early-life exposure to disasters with debt structure.

First, the cross-sectional analysis test is conducted in various enforcement environments. Based on bank monitor theory, banks can more successfully supervise borrowing companies (DASS and Massa, 2011; Fama, 1985). Unlike bondholders, the concentration of ownership of loan claims means that banks have considerable incentives to monitor strictly the management of borrowing firms. The complementary effect of external monitoring and bank debt financing is the vital argument of external monitoring mechanisms. In high enforcement environments, firms no longer require bank monitoring. External monitoring promotes strengthened board governance, resulting in reduced bank monitoring and insiders preferring lower levels of bank debt financing. Thus, CEOs experienced in early life disasters would reduce bank debt in high enforcement environments to avoid strict bank monitoring. In our analysis, we define the enforcement environment as the proximity between the firm's headquarters and the nearest SEC branch. If the proximity is closer to the SEC office, it signifies that there is a higher level of enforcement. In the case of the firm's headquarters and the nearest SEC branch being more than 100 miles apart, this would mean a low enforcement environment, whilst a distance of less than 100 miles would indicate a high enforcement environment (Kedia and Rajgopal, 2011). The results are shown in Panel A of Table 3.8. Our findings suggest that firms with a high enforcement environment have a significant impact on their debt structure. The estimated coefficients for $BANK$ and $PUBLIC$ in high enforcement environments are statistically significant at -0.114 and 0.112, with t-statistics of -3.41 and 3.31, respectively. The results support our expectation that enhanced external monitoring motivates CEOs who have been influenced by disasters to avoid the strict control of bank loans by shifting to public debt.

Furthermore, we investigate the cross-sectional analysis of various backgrounds regarding the risk of unemployment. According to Ben-Nasr's (2019) research, unemployment insurance benefits can decrease the perceived risk of bankruptcy among employees. If employees have substantial access to high unemployment insurance benefits, they can receive significant

compensation in the event of bankruptcy. This consideration of the likelihood of bankruptcy could influence the choice between bank loans and public debt. Firms at high risk of bankruptcy often shift their focus away from public debt towards bank loans (e.g., Denis and Mihov, 2003). This is because banks have a greater ability to renegotiate contracts or enforce liquidation in the event of bankruptcy compared to public debtholders. Conversely, firms that operate in states with higher unemployment insurance and fewer concerns about bankruptcy tend to select public debt over bank loans. Insufficient unemployment benefits may necessitate a heightened requirement for banks to monitor their clients, a task within the capability and motivation of banks. Improved supervision bolsters effectiveness and minimizes the risk of bankruptcy. Based on bank monitoring theory, CEOs who have experienced disasters during their early life tend to decrease their bank debt to evade rigorous monitoring. Thus, high unemployment benefits moderate the risk of unemployment and bankruptcy perceived by workers, leading to high risk-taking CEOs ultimately reducing the need for bank supervision to avoid strict monitoring. Follow Ben-Nasr's (2019) study, we identify unemployment risk via the state unemployment insurance policy. We group our firms by their median unemployment insurance payment, dividing them into two categories. A firm with an unemployment insurance payment above the median indicates less unemployment risk (i.e., greater insurance benefit). Our results are shown in Panel B of Table 3.8. Our findings indicate that firms with lower unemployment risk have a significant impact on their debt structure. The estimated coefficients for $BANK$ and $PUBLIC$ in a low unemployment risk are statistically significant at -0.135 and 0.105, with t-statistics of -4.37 and 3.08, respectively. When firms are led by CEOs with past disaster experiences, there is a tendency to decrease bank debt and increase public debt under the low unemployment risk conditions.

Finally, we investigate the cross-sectional test with different levels of risk severity. It is argued that companies facing high-risk scenarios, such as financial distress, might reduce their bank

debt to avoid intensive scrutiny from banks, particularly if the CEO has previous experience with disaster in their early life. Drawing on bank monitoring theory, firms led by CEOs with a greater appetite for risk tend to be less reliant on bank debt in order to evade stringent monitoring by banks. Bolton and Scharfstein (1996) propose a theoretical framework for bank flexibility, identifying that market debt ownership tends to be more dispersed relative to bank debt. This creates a free-rider dilemma, whereby individual market creditors lack the incentive to engage in debt renegotiations. The fragmentation of bondholders reduces individual motivation to negotiate debt repayments and may lead to inadequate monitoring of the company. Thus, in firms facing precarious situations, risk-seeking CEOs may transition from bank loans to public debt in order to pursue this ineffective monitoring strategy. We employed O-score (Ohlson, 1980) to capture firms with varying levels of risk severity[24]. To conduct the test, we divided our firms into two groups based on the O-score median. A firm with an O-score below the median indicates low financial risk. The results, shown in Panel C of Table 3.8, reveal that the estimated coefficients for $BANK$ and $PUBLIC$ in high financial risk scenarios are statistically significant at −0.122 and 0.123, with t-statistics of -3.68 and 3.43, respectively. The findings indicate that firms facing elevated risks exhibit a preference for issuing public debt instead of borrowing from banks. This supports our hypothesis that CEOs who hold a risk-loving attitude might shift towards public debt to avoid effective monitoring of their debt obligations in high-severity risk situations.

**[Insert Table 3.8 Here]**

[24] The formula for the O-score is as follows:

*O*=−1.32−0.407**Size*+6.03**Total Liabilities to Total Assets*−1.43**Working Capital to Total Assets*+0.076**Current Liabilities to Current Assets*−1.72**Net Income to Total Assets*−2.37**Funds from Operations to Total Liabilities* + 0.285**No Credit Interval* − 1.72**Book Value of Equity to Total Liabilities*

### *3.4.5 Robustness Tests*

In this section, a series of robustness tests are conducted. First, fixed effects for CEO birth-year and growth-place at the city level were added to eliminate any potential cohort-related effects (O'Sullivan et al. 2021). The resulting coefficients are shown in columns (1) and (2) of Table 3.9, where they are -0.191 and 0.123, with t-statistics significant at the 1% level and 5% level, respectively. The findings corroborate our primary results that CEOs who experienced disasters in their early lives opt for issuing public debt instead of borrowing bank debt.

Additionally, as a robustness test to verify our main findings presented in Table 3.3, we conducted a subsample test. Our sample consists of 687 CEOs from 50 different states, with 3564 observations. The majority of our sample observations originate from New York (542), Pennsylvania (261), and Ohio (217). We repeated our primary tests by excluding companies from the top three states to investigate whether our results are influenced by states in the majority. The findings are presented in columns (3) and (4) of Table 3.9. The coefficient values of columns (3) and (4) are -0.067 and 0.074, respectively, with t-statistics that are statistically significant at 5% levels.

Furthermore, we adjust for various firm characteristics and CEO attributes recommended in previous research (Cronqvist et al. 2015). Firms incorporating cash flow ($CASH\_FLOW$), dividend payment ($DIV$), research and development expenditure ($R\&D$), and firm age ($FIRM\_AGE$). CEO attributes incorporating CEO's age ($AGE$), gender ($MALE$), length of service ($TENURE$), legal training ($LAW$), and equity-based compensation ($DELTA$ and $VEGA$). $CASH\_FLOW$ is the sum of income before extraordinary items and depreciation and amortization, divided by total assets. $DIV$ is calculated as common dividends divided by total assets, which negative with bank debt but positive with public debt. $R\&D$ is the research and development expense divided by total asset which should negative with bank debt but positive with public debt (Cronqvist et al. 2015). Replace research and development expense equal to

0 if that year is missing. $FIRM\_AGE$ is the natural log of one plus the number of years since the firm appears in Compustat. We ascertain CEO's age ($AGE$) by calculating the discrepancy between the fiscal year and the CEO's birth year. The CEO gender ($MALE$) variable takes the value of one if the CEO is male and zero if the CEO is female. Women typically exhibit greater conservatism, which should lead to a reduction in high-risk debt, such as public debt (Chen et al. 2021). CEO tenure ($TENURE$) is defined as the number of years between the fiscal year and the year in which the CEO assumed the position. The CEO law background ($LAW$) variable equals one if the CEO holds a JD or LLD degree and zero otherwise. CEO delta ($DELTA$) is the change in the dollar value of the executive's wealth for a one percentage point change in stock price. Similarly, CEO vega ($VEGA$) represents the change in the dollar value of executive's assets for every 0.01 change in the annualised standard deviation of stock returns (Coles et al. 2006). These indices encourage CEOs to adopt a risk-taking attitude, where low CEO delta and high CEO vega should lead to an increase in bank debt to avoid bankruptcy risk.The findings are presented in columns (5) and (6) of table 3.9. The results of all the robustness tests demonstrate that companies headed by a CEO who has experienced a disaster early in life would notably decrease their bank debt while increasing their public debt.

**[Insert Table 3.9 Here]**

### *3.4.6 Childhood Memory*

In line with psychological development, children's personality traits stabilise as they approach puberty (Caspi et al. 2005). Therefore, CEOs who were exposed to disaster events during childhood are more likely to be affected compared to those who experienced these events during adolescence. In order to verify this assumption, we designate $CEODISCHILD$ as "1" if the CEO encountered early-life disasters between the ages of 5 and 10; otherwise, "0". Both the bank debt ratio ($BANK$) and the public debt ratio ($PUBLIC$) were regressed on $CEODISCHILD$ and a set of controls. In our sample, 62 CEOs with childhood traumatic.

Columns (1) and (2) of table 3.10 present the findings of this investigation. The coefficient results of $CEODISCHILD$ in table 3.10 of column (1) is -0.063 with 10% significantly negative in the bank debt ratio. One standard deviation increases in $CEODISCHILD$ is associated with a 5.14% ($= -0.063 * 0.288/0.353$) decrease in the bank debt ratio. The coefficient results of $CEODISCHILD$ in table 10 of column (2) is 0.073 with 5% significantly positive in the public debt ratio. One standard deviation increases in $CEODISCHILD$ is associated with a 3.86% ($= 0.073 * 0.288/0.544$) increase in the public debt ratio. However, the regression results do not strongly support that CEOs with childhood disaster experience would be more impacted.

**[Insert Table 3.10 Here]**

### 3.5 Conclusions

Examining a longitudinal dataset of U.S. companies, our study discerns a noteworthy correlation: firms led by CEOs who underwent early-life disasters exhibit significantly elevated public debt ratios and diminished bank debt ratios on average. These results align with the bank monitor theory, suggesting that banks intensify their supervision and monitoring of firms helmed by risk-taking executives. Consequently, CEOs with higher risk tolerance may opt to shift their reliance from bank debt to public debt as a strategic maneuver to sidestep stringent monitoring.

To address potential endogeneity concerns, we deploy three robust methodologies. First, employing propensity score matching (PSM), we rerun our baseline regression with matched samples. Second, utilizing entropy balancing, we corroborate our main findings with matched samples, validating the robustness of our results. Lastly, we employ the Differences-in-differences (DID) method, examining changes in debt ratios surrounding CEO turnover events with varying risk preferences. The results from this test affirm the causative link between CEOs' early-life disaster experiences and the composition of corporate debt.

To validate the robustness and non-randomness of our findings, we conduct a placebo test. Creating a simulated variable termed $pseudo-CEODIS$, based on randomly selected childhood locations, we substitute it for the true measure of early-life disaster experience in our analysis. Iterating this process 500 times, we generate coefficient estimates for the relationship between $pseudo-CEODIS$ and debt structure. The empirical distribution of these $pseudo-CEODIS$ coefficients demonstrates that the actual $CEODIS$ coefficient estimates fall within the extreme range, negating the possibility of the observed correlation being a chance occurrence.

Further enriching our analysis, we conduct cross-sectional examinations to elucidate potential channels through which CEOs' early-life disaster experiences relate to debt structure. Notably, firms facing high-risk situations or stringent enforcement environments tend to have elevated public debt levels, while low unemployment risk exerts a more pronounced influence on firm debt structure decisions.

To fortify our results, we undertake three robustness tests. Firstly, we introduce CEO year of birth and place of upbringing as fixed effects to mitigate cohort effects. Secondly, we exclude the top three U.S. states with the highest CEO concentration to minimize clustering effects. Thirdly, we integrate additional CEO trait controls. Our supplementary findings reveal a proclivity for firms led by CEOs with childhood disaster experiences to opt for public debt issuance over bank borrowing, underscoring the enduring impact of such early-life events on corporate financial decisions.

The implications of these results are manifold. Firstly, they suggest that personal experiences of CEOs are an important determinant of corporate financial policies, which can influence the overall risk profile and financial stability of firms. This insight can be valuable for stakeholders, including investors, analysts, and policymakers, in understanding and predicting corporate behavior. Secondly, our findings highlight the potential benefits of considering psychological

and behavioral traits in executive recruitment and succession planning. Firms may need to evaluate not just the professional qualifications of potential leaders but also their personal histories and how these might impact their strategic decisions.

In conclusion, our study demonstrates that CEOs' early-life disaster experiences significantly influence corporate debt structure, aligning with the bank monitor theory and broadening our understanding of the behavioral underpinnings of financial decision-making. Future research could explore additional personal traits and experiences to further elucidate the complex relationship between executive behavior and corporate finance.

## Appendix A. Variable definitions

| Variable name | Variable definition | Source |
|---|---|---|
| *Denpend variables* | | |
| BANK | The ratio of bank debt to total debt, calculated as the sum of term loans and revolving credit divided by total debt. | Capital IQ |
| PUBLIC | The ratio of public debt to total debt, calculated as the sum of senior bonds and notes, and subordinated bonds and notes divided by total debt. | Capital IQ |
| *Independent variables* | | |
| CEODIS | Indicator is equal to one if CEO with early-life disaster experience. | Manually collect |
| CEODISCHILD | Indicator is equal to one if CEO with disaster experience during age 5-10. | Manually collect |
| *Control variables* | | |
| SIZE | The natural log of total assets measured in millions of U.S. dollars. | Compustat |
| LEV | The sum of long-term debt and debt in current liabilities divided by total assets. | Compustat |
| TANGB | Net property, plant, and equipment divided by total assets. | Compustat |
| ROA | Earnings before interest and taxes (EBIT) divided by total assets. | Compustat |
| Q | The sum of market value of equity plus book value of debt divided by total assets, where market value of equity equals price per share times the total number of shares outstanding, and book value of debt equals total assets minus book value of equity. | Compustat |
| ZSCORE | Altman's (1968) Z-score, calculated as (1.2 * working capital + 1.4 * retained earnings + 3.3 * earnings before interest and taxes + 0.999 * sales)/total assets+0.6 * (market value of equity/book value of debt). | Compustat |
| UNRATED | Indicator is equal to one if the firm without an S&P issuer credit rating. | Compustat |
| INV_GRD | Indicator is equal to one if the firm has above BBB- level reputation credit rating | Compustat |
| *Additional control variables* | | |
| *Firm characteristics* | | |
| CASH_FLOW | The sum of income before extraordinary items and deprecation and amortization, divided by total assets. | Compustat |
| DIV | Common dividends divided by total assets. | Compustat |
| R&D | Research and development expense divided by total assets. Replace research and development expense equal to 0 if that year is missing. | Compustat |
| FIRM_AGE | The natural log of one plus the number of years since the firm appears in Compustat. | Compustat |
| *CEO characteristics* | | |
| AGE | The discrepancy between the fiscal year and the CEO's birth year. | ExecuComp & Manually collect |
| MALE | Indicator is equal to one if the CEO is male and zero if the CEO is female | ExecuComp |
| TENURE | The number of years between the fiscal year and the year in which the CEO assumed the position | ExecuComp |
| LAW | Indicator is equal one if the CEO holds a JD or LLD degree and zero otherwise | Manually collect |
| DELTA | The change in the dollar value of the executive's wealth for a one percentage point change in stock price | Coles et al. 2006 |
| VEGA | The change in the dollar value of executive's assets for every 0.01 change in the annualised standard deviation of stock returns | Coles et al. 2006 |

**Table 3.1 Descriptive statistics**

| Variables | Observations | Mean | Median | 25% | 75% | Std.Dev. |
|---|---|---|---|---|---|---|
| BANK | 3,564 | 0.353 | 0.271 | 0.080 | 0.554 | 0.317 |
| PUBLIC | 3,564 | 0.544 | 0.568 | 0.310 | 0.811 | 0.314 |
| CEODIS | 3,564 | 0.117 | 0.000 | 0.000 | 0.000 | 0.322 |
| CEODISCHILD | 3,564 | 0.091 | 0.000 | 0.000 | 0.000 | 0.288 |
| SIZE | 3,564 | 8.645 | 8.679 | 7.550 | 9.769 | 1.589 |
| LEV | 3,564 | 0.228 | 0.217 | 0.126 | 0.318 | 0.143 |
| TANGAB | 3,564 | 0.303 | 0.238 | 0.125 | 0.443 | 0.225 |
| ROA | 3,564 | 0.049 | 0.052 | 0.024 | 0.085 | 0.076 |
| Q | 3,564 | 1.829 | 1.525 | 1.213 | 2.087 | 0.975 |
| ZSCORE | 3,564 | 3.430 | 2.984 | 1.928 | 4.300 | 2.353 |
| UNRATED | 3,564 | 0.220 | 0.000 | 0.000 | 0.000 | 0.414 |
| INV_GRD | 3,564 | 0.768 | 1.000 | 1.000 | 1.000 | 0.422 |

Note: This table provides the summary statistics. The Appendix A contains all variable definitions.

**Table 3.2 Correlation matrix**

| | | （1） | （2） | （3） | （4） | （5） | （6） | （7） | （8） | （9） | （10） | （11） | （12） |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BANK | （1） | 1.000 | | | | | | | | | | | |
| PUBLIC | （2） | -0.817*** | 1.000 | | | | | | | | | | |
| CEODIS | （3） | -0.091*** | 0.088*** | 1.000 | | | | | | | | | |
| CEODISCHILD | （4） | -0.072*** | 0.072*** | 0.870*** | 1.000 | | | | | | | | |
| SIZE | （5） | -0.440*** | 0.288*** | 0.050*** | 0.026 | 1.000 | | | | | | | |
| LEV | （6） | -0.127*** | 0.150*** | 0.009 | -0.001 | 0.097*** | 1.000 | | | | | | |
| TANGAB | （7） | -0.056*** | 0.001 | -0.015 | 0.026 | 0.094*** | 0.221*** | 1.000 | | | | | |
| ROA | （8） | -0.004 | -0.031* | -0.047*** | -0.065*** | 0.150*** | -0.212*** | -0.040** | 1.000 | | | | |
| Q | （9） | 0.029* | -0.016 | -0.026 | -0.029* | -0.041** | -0.216*** | -0.143*** | 0.448*** | 1.000 | | | |
| ZSCORE | （10） | 0.152*** | -0.141*** | -0.062*** | -0.050*** | -0.150*** | -0.531*** | -0.174*** | 0.547*** | 0.748*** | 1.000 | | |
| UNRATED | （11） | 0.415*** | -0.317*** | -0.009 | -0.009 | -0.570*** | -0.291*** | -0.112*** | -0.053*** | 0.109*** | 0.220*** | 1.000 | |
| INV_GRD | （12） | -0.411*** | 0.312*** | -0.006 | 0.006 | 0.572*** | 0.275*** | 0.105*** | 0.065*** | -0.103*** | -0.202*** | -0.967*** | 1.000 |

Note: This table presents the correlation matrix of the variables used in our research. The Appendix A contains all variable definitions.

**Table 3.3 CEO with early-life disaster experience and debt structure**

| Variables | BANK (1) | PUBLIC (2) | BANK (3) | PUBLIC (4) | BANK (5) | PUBLIC (6) |
|---|---|---|---|---|---|---|
| CEODIS | -0.081** | 0.081*** | -0.068** | 0.074*** | -0.068** | 0.074*** |
| | (-2.39) | (2.67) | (-2.18) | (2.59) | (-2.21) | (2.62) |
| SIZE | | | -0.070*** | 0.036*** | -0.070*** | 0.036*** |
| | | | (-10.24) | (4.61) | (-10.34) | (4.66) |
| LEV | | | -0.071 | 0.159* | -0.071 | 0.159* |
| | | | (-0.92) | (1.92) | (-0.93) | (1.94) |
| TANGAB | | | -0.018 | -0.022 | -0.018 | -0.022 |
| | | | (-0.28) | (-0.32) | (-0.29) | (-0.33) |
| ROA | | | 0.148 | -0.190 | 0.148 | -0.190 |
| | | | (1.34) | (-1.61) | (1.36) | (-1.62) |
| Q | | | -0.045*** | 0.042** | -0.045*** | 0.042** |
| | | | (-2.81) | (2.54) | (-2.84) | (2.56) |
| ZSCORE | | | 0.013 | -0.010 | 0.013 | -0.010 |
| | | | (1.32) | (-1.03) | (1.33) | (-1.04) |
| UNRATED | | | 0.045 | -0.078 | 0.045 | -0.078 |
| | | | (0.48) | (-0.83) | (0.49) | (-0.84) |
| INV_GRD | | | -0.105 | 0.066 | -0.105 | 0.066 |
| | | | (-1.18) | (0.75) | (-1.19) | (0.75) |
| Observations | 3,564 | 3,564 | 3,564 | 3,564 | 3,564 | 3,564 |
| R-squared | 0.162 | 0.128 | 0.353 | 0.228 | 0.807 | 0.499 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on debt structure. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBLIC$ refers to public debt divided by total debt. Other variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. The regressions are performed by ordinary least squares (OLS) or Tobit depending on the model. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.4 PSM results**

| Panel A: PSM match results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-matching | | | | Post-matching | | | |
| | Treated | Control | Difference | t-statistics | Treated | Control | Differences | t-statistics |
| SIZE | 8.863 | 8.616 | 0.247 | 2.99 | 8.863 | 8.807 | 0.057 | 0.51 |
| LEV | 0.232 | 0.228 | 0.004 | 0.54 | 0.232 | 0.231 | 0.001 | 0.06 |
| TANGAB | 0.293 | 0.304 | -0.011 | -0.89 | 0.293 | 0.312 | -0.019 | -1.15 |
| ROA | 0.039 | 0.05 | -0.011 | -2.81 | 0.039 | 0.038 | 0 | 0.08 |
| Q | 1.76 | 1.838 | -0.078 | -1.54 | 1.76 | 1.785 | -0.025 | -0.41 |
| ZSCORE | 3.026 | 3.483 | -0.457 | -3.73 | 3.026 | 2.973 | 0.054 | 0.36 |
| UNRATED | 0.211 | 0.222 | -0.011 | -0.51 | 0.211 | 0.213 | -0.002 | -0.08 |
| INV_GRD | 0.761 | 0.769 | -0.008 | -0.37 | 0.761 | 0.758 | 0.002 | 0.08 |

| Panel B: PSM regression results | | |
|---|---|---|
| | BANK | PUBLIC |
| Variables | (1) | (2) |
| CEODIS | -0.076** | 0.093*** |
| | (-2.46) | (3.00) |
| SIZE | -0.051*** | 0.020 |
| | (-3.77) | (1.39) |
| LEV | -0.171 | 0.330** |
| | (-1.14) | (2.15) |
| TANGAB | 0.014 | -0.075 |
| | (0.11) | (-0.58) |
| ROA | 0.139 | -0.304 |
| | (0.76) | (-1.47) |
| Q | -0.065** | 0.055* |
| | (-2.05) | (1.73) |
| ZSCORE | 0.022 | -0.016 |
| | (1.43) | (-1.09) |
| UNRATED | -0.056 | -0.008 |
| | (-0.42) | (-0.06) |
| INV_GRD | -0.209* | 0.146 |
| | (-1.72) | (1.23) |
| Observations | 836 | 836 |
| R-squared | 0.369 | 0.262 |
| Year FE | Yes | Yes |
| Industry FE | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on debt structure based on propensity score matching (PSM). Panel A reports PSM match results. Panel B reports PSM regression results. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBLIC$ refers to public debt divided by total debt. Other variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.5 Entropy balance results**

| Panel A: Entropy balancing match results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Before: Without weighting | | | | After: With weighting | | | |
| | Treated | Control | Difference | t-statistics | Treated | Control | Difference | t-statistics |
| SIZE | 8.863 | 8.616 | 0.247 | 2.99 | 8.863 | 8.863 | 0.000 | 0.00 |
| LEV | 0.232 | 0.228 | 0.004 | 0.54 | 0.232 | 0.232 | 0.000 | 0.00 |
| TANGAB | 0.293 | 0.304 | -0.011 | -0.89 | 0.293 | 0.293 | 0.000 | 0.00 |
| ROA | 0.039 | 0.050 | -0.011 | -2.81 | 0.039 | 0.039 | 0.000 | 0.00 |
| Q | 1.760 | 1.838 | -0.078 | -1.54 | 1.760 | 1.760 | 0.000 | 0.00 |
| ZSCORE | 3.026 | 3.483 | -0.457 | -3.73 | 3.026 | 3.027 | -0.001 | 0.00 |
| UNRATED | 0.211 | 0.222 | -0.011 | -0.51 | 0.211 | 0.211 | 0.000 | 0.00 |
| INV_GRD | 0.761 | 0.769 | -0.008 | -0.37 | 0.761 | 0.761 | 0.000 | 0.00 |

| Panel B: Entropy balancing regression results | | |
|---|---|---|
| | BANK | PUBLIC |
| Variables | (1) | (2) |
| CEODIS | -0.057** | 0.068*** |
| | (-2.25) | (2.73) |
| SIZE | -0.064*** | 0.034*** |
| | (-6.61) | (3.43) |
| LEV | -0.128 | 0.250** |
| | (-1.21) | (2.19) |
| TANGAB | 0.002 | -0.048 |
| | (0.02) | (-0.52) |
| ROA | 0.174 | -0.350** |
| | (1.26) | (-2.25) |
| Q | -0.053** | 0.048** |
| | (-2.37) | (2.25) |
| ZSCORE | 0.019 | -0.013 |
| | (1.58) | (-1.13) |
| UNRATED | -0.035 | -0.018 |
| | (-0.30) | (-0.16) |
| INV_GRD | -0.137 | 0.088 |
| | (-1.29) | (0.85) |
| Observations | 3,564 | 3,564 |
| R-squared | 0.334 | 0.236 |
| Year FE | Yes | Yes |
| Industry FE | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on debt structure based on entropy balancing match. Panel A reports entropy balancing results. Panel B reports entropy balancing match results. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBLIC$ refers to public debt divided by total debt. Other variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.6 Changes in bank and public debt ratio around CEO turnover events**

| Variables | BANK<br>(1) | PUBLIC<br>(2) |
|---|---|---|
| CEODIS | -0.023 | 0.026 |
| | (-0.59) | (0.74) |
| TREAT | 0.084** | -0.133*** |
| | (2.39) | (-3.05) |
| CEODIS*TREAT | -0.055** | 0.141*** |
| | (-2.05) | (3.72) |
| SIZE | -0.080*** | 0.037*** |
| | (-8.39) | (2.80) |
| LEV | -0.159 | 0.225 |
| | (-1.42) | (1.60) |
| TANGAB | -0.062 | -0.006 |
| | (-0.54) | (-0.05) |
| ROA | 0.137 | -0.216 |
| | (0.81) | (-1.08) |
| Q | -0.055** | 0.030 |
| | (-2.49) | (1.20) |
| ZSCORE | 0.018 | -0.014 |
| | (1.33) | (-0.91) |
| UNRATED | 0.031 | -0.080 |
| | (0.23) | (-0.64) |
| INV_GRD | -0.173 | 0.116 |
| | (-1.45) | (1.02) |
| Observations | 1,370 | 1,370 |
| R-squared | 0.493 | 0.333 |
| Year FE | Yes | Yes |
| Industry FE | Yes | Yes |

Note: This table presents the difference-in-differences (DiD) regression results of changes in debt ratio around CEO turnover events during the study period from 2002 to 2017. The treatment group consists of firms that experienced CEO turnover events with CEO change risk attitude (e.g. CEO without early-life disaster experience to CEO with early-life disaster experience). Control firms are those firms that have not experienced CEO turnover events in the same period. $CEODIS * TEART$ is an interactive variable. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBLIC$ refers to public debt divided by total debt. Other variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.7 Placebo test**

| | BANK | PUBLIC |
|---|---|---|
| | (1) | (2) |
| Mean β for pseudo-CEODIS | 0.003 | 0.000 |
| Min β for pseudo-CEODIS | -0.036 | -0.044 |
| 1% percentile β for pseudo-CEODIS | -0.031 | -0.039 |
| 5% percentile β for pseudo-CEODIS | -0.022 | -0.027 |
| 25% percentile β for pseudo-CEODIS | -0.009 | -0.011 |
| Median β for pseudo-CEODIS | 0.003 | 0.000 |
| 75% percentile β for pseudo-CEODIS | 0.014 | 0.011 |
| 95% percentile β for pseudo-CEODIS | 0.030 | 0.026 |
| 99% percentile β for pseudo-CEODIS | 0.046 | 0.038 |
| Max β for pseudo-CEODIS | 0.054 | 0.062 |
| Coefficient of actual CEODIS in Table 3 | -0.068 | 0.074 |

Note: This table presents the results of placebo tests. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBLIC$ refers to public debt divided by total debt. We randomly assign a grow-up county to each CEO in our sample, generating a $pseudo - CEODIS$ variable, and use the $pseudo - DISASTER$ variable to estimate our baseline models. We repeat this procedure 500 times, thereby generating 500 coefficient estimates of the $pseudo - CEODIS$ variable. These estimates are used to construct an empirical distribution of the $pseudo - CEODIS$ coefficient. For comparison, for each $BANK$ and $PUBLIC$ we also report the actual estimate of the $CEODIS$ coefficient, replicated from Table 3.3.

**Table 3.8 Cross-sectional tests**

| Panel A: Enforcement | | | | |
|---|---|---|---|---|
| (1) SEC distance | | | | |
| | Low | | High | |
| | (1) | (2) | (3) | (4) |
| Variables | BANK | PUBLIC | BANK | PUBLIC |
| CEODIS | -0.039 | 0.063 | -0.114*** | 0.112*** |
| | (-0.54) | (0.95) | (-3.41) | (3.31) |
| Observations | 1,486 | 1,486 | 1,777 | 1,777 |
| R-squared | 0.400 | 0.289 | 0.380 | 0.282 |
| Controls | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| Panel B: Unemployment risk | | | | |
| (2) Unemployment insurance | | | | |
| | Low | | High | |
| | (1) | (2) | (3) | (4) |
| Variables | BANK | PUBLIC | BANK | PUBLIC |
| CEODIS | -0.135*** | 0.105*** | -0.014 | 0.062 |
| | (-4.37) | (3.08) | (-0.33) | (1.53) |
| Observations | 1,695 | 1,695 | 1,749 | 1,749 |
| R-squared | 0.445 | 0.308 | 0.345 | 0.232 |
| Controls | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| Panel C: Severity of risk | | | | |
| (3) O score | | | | |
| | Low | | High | |
| | (1) | (2) | (3) | (4) |
| Variables | BANK | PUBLIC | BANK | PUBLIC |
| CEODIS | -0.015 | 0.023 | -0.122*** | 0.123*** |
| | (-0.37) | (0.63) | (-3.68) | (3.43) |
| Observations | 1,766 | 1,766 | 1,770 | 1,770 |
| R-squared | 0.421 | 0.263 | 0.342 | 0.259 |
| Controls | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |

Note: This table presents the results of the additional analysis. We do the tests under three different circumstances. In panel A, firms are classified with low enforcement or high enforcement. Panel B shows the firms face with different unemployment risk. Panel C shows the firms with different distress risk. We identify firm distress risk by O score. $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBULC$ refers to public debt divided by total debt. All the control variables are the same as baseline test. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.9 Robustness results**

| Variables | BANK (1) | PUBLIC (2) | BANK (3) | PUBLIC (4) | BANK (5) | PUBLIC (6) |
|---|---|---|---|---|---|---|
| CEODIS | -0.191*** | 0.123** | -0.067** | 0.074** | -0.067** | 0.077*** |
| | (-2.76) | (2.30) | (-1.98) | (2.43) | (-2.24) | (2.71) |
| SIZE | -0.065*** | 0.030*** | -0.076*** | 0.041*** | -0.063*** | 0.041*** |
| | (-6.54) | (5.01) | (-9.54) | (4.57) | (-7.33) | (4.29) |
| LEV | -0.093 | 0.180*** | -0.016 | 0.068 | -0.125 | 0.172** |
| | (-1.13) | (3.35) | (-0.17) | (0.67) | (-1.57) | (1.97) |
| TANGAB | -0.064 | -0.089 | -0.006 | 0.020 | -0.046 | 0.012 |
| | (-0.74) | (-1.64) | (-0.08) | (0.27) | (-0.70) | (0.17) |
| ROA | 0.152 | -0.207** | 0.241* | -0.279** | 0.138 | -0.013 |
| | (1.57) | (-2.53) | (1.87) | (-2.03) | (0.55) | (-0.05) |
| Q | -0.029* | 0.033*** | -0.047** | 0.039* | -0.022 | 0.027 |
| | (-1.71) | (3.29) | (-2.42) | (1.95) | (-1.12) | (1.36) |
| ZSCORE | 0.011 | -0.012** | 0.012 | -0.009 | 0.009 | -0.008 |
| | (1.20) | (-2.41) | (0.91) | (-0.72) | (0.81) | (-0.74) |
| UNRATED | -0.000 | -0.123*** | 0.004 | -0.031 | 0.062 | -0.090 |
| | (-0.00) | (-2.58) | (0.04) | (-0.30) | (0.53) | (-0.81) |
| INV_GRD | -0.136 | 0.022 | -0.151 | 0.108 | -0.101 | 0.061 |
| | (-1.58) | (0.48) | (-1.52) | (1.11) | (-0.90) | (0.58) |
| CASH_FLOW | | | | | -0.030 | -0.084 |
| | | | | | (-0.16) | (-0.41) |
| DIV | | | | | -0.760** | 0.258 |
| | | | | | (-2.13) | (0.61) |
| R&D | | | | | -0.936*** | 0.723** |
| | | | | | (-2.92) | (2.26) |
| FIRM_AGE | | | | | -0.001* | -0.001 |
| | | | | | (-1.86) | (-1.21) |
| AGE | | | | | -0.000 | -0.002 |
| | | | | | (-0.24) | (-0.97) |
| MALE | | | | | 0.024 | -0.056 |
| | | | | | (0.64) | (-1.32) |
| TENURE | | | | | -0.000 | 0.001 |
| | | | | | (-0.19) | (0.77) |
| LAW | | | | | -0.029 | 0.071 |
| | | | | | (-0.63) | (1.51) |
| DELTA | | | | | 0.000** | -0.000 |
| | | | | | (2.04) | (-0.22) |
| VEGA | | | | | -0.000** | 0.000 |
| | | | | | (-2.53) | (0.26) |
| Observations | 3,468 | 3,468 | 2,544 | 2,544 | 3,226 | 3,226 |
| R-squared | 0.609 | 0.520 | 0.368 | 0.246 | 0.378 | 0.240 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Birth_year FE | Yes | Yes | No | No | No | No |
| Growth_Place_City FE | Yes | Yes | No | No | No | No |

Note: This table presents the results of the robustness checks. We add CEO growth background as controls in columns (1) and (2). Columns (3) and (4) report the results after deleting the top 3 U.S. states of the CEOs cluster. We add others characteristic as controls in columns (5) and (6). $CEODIS$ is a dummy variable equal to one if a firm is led by CEO with early-life disaster experience, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBULC$ refers to public debt divided by total debt. Other variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 3.10 Childhood memory**

| Variables | BANK (1) | PUBLIC (2) |
|---|---|---|
| CEODISCHILD | -0.063* | 0.073** |
| | (-1.71) | (2.19) |
| SIZE | -0.071*** | 0.037*** |
| | (-10.31) | (4.68) |
| LEV | -0.070 | 0.159* |
| | (-0.91) | (1.92) |
| TANGAB | -0.011 | -0.029 |
| | (-0.18) | (-0.42) |
| ROA | 0.142 | -0.183 |
| | (1.29) | (-1.54) |
| Q | -0.045*** | 0.043** |
| | (-2.86) | (2.58) |
| ZSCORE | 0.013 | -0.011 |
| | (1.36) | (-1.07) |
| UNRATED | 0.054 | -0.088 |
| | (0.61) | (-0.98) |
| INV_GRD | -0.094 | 0.055 |
| | (-1.13) | (0.66) |
| Observations | 3,564 | 3,564 |
| R-squared | 0.352 | 0.227 |
| Year FE | Yes | Yes |
| Industry FE | Yes | Yes |

Note: This table presents the results of the CEO with disaster experience during childhood age. $CEODISCHILD$ is a dummy variable equal to one if a firm is led by CEO with life disaster experience at child age, and zero otherwise. $BANK$ refers to bank debt divided by total debt. $PUBULC$ refers to public debt divided by total debt. All the control variables are the same as baseline test. The constant term, industry fixed effects based on SIC 2-digital codes, and year fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

# Chapter 4: CEO Early-life Disaster Experience and Corporate Misconduct

## 4.1 Introduction

In recent years, there has been an inclination towards more and more heightened attention to how the previous experience of CEOs affects the decisions made by firms (e.g. Chen et al. 2021; Malmendier et al. 2011; O'Sullivan et al. 2021). The neuroscience study proves the long-term effects of early traumatic situations from natural disasters. This trauma can last a lifetime, leaving people with scars and changing their preferences (e.g., Franklin et al. 2012; Moles et al. 2004). Preferences change directly with behaviours change such as decisions and choices. Namely, people who experience trauma would impact selection behaviours. Hambrick and Mason's (1984) upper echelon theory proposes that an executive's personal experience influences their characteristics and psychological predispositions, which, in turn, shape their management style and determine their choice of corporate policies. Based on these theories, Bernile et al. (2017) investigated whether a CEO's early experience with disasters significantly affects their company's investment and financing decisions. O'Sullivan et al. (2021) discovered that CEOs who experience early-life disasters rely more on others and enhance the corporate social performance of their companies. Chen et al. (2021) employed a longitudinal sample of US companies to demonstrate that companies helmed by CEOs who experienced early-life disasters are more susceptible to stock price crashes. Nevertheless, the comprehension of how early-life disaster-experienced CEOs influence corporate misconduct remains insufficient.

There has been a variety of notable corporate wrongdoing, such as accounting impropriety (e.g. Enron in 2001 and WorldCom in 2002), financial reporting revisions, and options backdating. The extent of misbehaviour is far-reaching and encompasses several other forms for each type of misconduct. For example, there exist numerous distinct types of insider trading beyond insider tipping, including front-running (where brokers trade on information prior to a client's trade), contravention of client priority, and trading in advance of research reports. Several

methods exist for price manipulation, such as marking the opening and closing prices, portfolio pumping with misleading trades at the end of months, quarters, or years to influence market values, intraday ramping or gouging, market setting, pre-planned trades, influencing or rewarding other employees, intimidation or coordination, and monopolising or dominating market segments. Extensive media coverage of this corporate malpractice has triggered widespread condemnation and caused significant harm to the offender's reputation, leading to serious financial repercussions for both the companies and stakeholders (Karpoff and Lott Jr, 1993).

It is an empirical question of how CEOs with early-life disaster experiences affect corporate misconduct. On one hand, according to risk-taking theory, CEOs who have experienced disaster in their early lives may be more likely to engage in corporate misconduct. Traumatic experiences diminish the perception of loss associated with risk-taking and increase an individual's confidence in their ability to handle risky situations, making them more tolerant of risk (Aldwin, 2009; Taylor and Lobel, 1989). Eckel et al.'s (2009) study provides evidence that traumatic events increase individual risk tolerance. CEOs with higher equity incentives for taking risks are likely to exert pressure on their employees, resulting in longer working hours, labour law violations, and disregard for health and safety regulations (Heese and Pérez-Cavazos, 2020). Although these actions pose a risk, they might lead to increased productivity, improved performance, and ultimately, an increase in stock prices (Chircop et al. 2020). Therefore, CEOs who take substantial risks may use misconduct as a tool to reap benefits. On the other hand, the responsibility-enhancing theory posits that CEOs who have experienced adversity in their early years could mitigate corporate wrongdoing. According to Tedeschi et al. (1998), individuals join together in the face of natural disasters to overcome crisis and maintain robust connections. Hence, recognizing their own frailty and reliance on others during the recovery phase of a traumatic event leads to an intensified dedication to closed partnerships.

Psychological research demonstrates that individuals who have experienced trauma are more likely to take on greater social responsibility (see Staub and Vollhardt, 2008; Zoellner and Maercker, 2006). In particular, those who have faced natural disasters in their early years tend to form strong interpersonal bonds and assume a greater responsibility for others. Additionally, Narvaez et al. (2019) found that children's early life experiences significantly impact their wellbeing, moral development, and engaged moral orientation. Specifically, their research demonstrated a direct relationship between childhood experiences with pain and subsequent prosocial behaviours. Individuals with higher moral standards and ideologies tend to be less self-centred and more socially focused in their behavioural decisions. Furthermore, early life experiences play a crucial role in shaping an individual's sense of conscience, as argued by Berkowitz and Grych (1998). Such experiences influence the establishment of moral standards and behavioural codes, promoting ethical conscientiousness and vigilance, not only in regulating one's own actions but also in monitoring others' misconduct. Thus, CEOs with early-life disaster experiences focus on the stakeholders' benefits and prefer to monitor immoral behaviour.

To examine the study, we utilised a CEO sample who were born in the United States and manually gathered their biographical data, including birth dates, cities of birth, educational histories, among other facts. By integrating CEO data with a comprehensive database of natural disasters at the county level in the United States, we can distinguish between CEOs who encountered natural disasters in their formative years (ages 5 to 15) and those who did not (Bernile et al. 2017). Following Zaman et al. (2013), this study computes corporate misconduct by taking into account the total amount and number of firm violations. A fixed effects model, which integrates industry fixed effects based on SIC 2-digit codes, as well as year, CEO birth year, and CEO upbringing fixed effects, is employed. A regression analysis is performed through ordinary least squares (OLS), and standard errors are clustered at the firm level. The

baseline findings indicate that companies led by CEOs who have experienced early-life disasters do not have a significant impact on corporate misconduct.

The primary outcomes do not endorse a connection between a CEO's early-life disaster experience and corporate misconduct. But, as with previous studies on CEO traits and corporate behaviour, possible endogeneity is considered in inspecting the effect of CEOs' early-life disaster experiences on corporate misconduct. In particular, the findings could be affected by company- or industry-specific influences that were not evaluated in our examination. To address this, we utilised a matched sample test employing propensity score matching (PSM) and entropy balancing to procure matched samples. PSM generates a propensity score, indicating the probability of a unit with certain characteristics being assigned to the treatment group in contrast to the control group. By balancing variables between the treated and control groups, the scores can eliminate selection bias in observational research. Similarly, Hainmueller (2012) introduced an entropy balancing approach to match treatment and control observations by creating a set of matching weights based on the features of the treatment and control groups. Moreover, to examine the causal link between a CEO's early-life disaster experience and corporate misconduct, we evaluated CEO turnover events and observed variations in corporate misconduct related to these incidents. We utilised the Difference-in-Differences method. The findings remain unchanged. We have not identified a significant correlation between CEOs with early-life disaster experience and corporate misconduct.

We present compelling evidence that companies headed by CEOs who went through early-life disasters have no influence on corporate wrongdoing. Firstly, we utilise an alternate dependent variable to conduct the regression analysis. We employ a binary variable where a firm with a violation in a year is 1, otherwise, it is 0 to identify corporate misconduct. Additionally, we carry out subsample testing, erasing states with the top 3 CEO clusters to prevent selection bias. Furthermore, we investigate how CEO traits affect the corporate misconduct of firms. Prior

research has shown that individual characteristics can influence investment style (e.g., Cronqvist et al. 2015). Therefore, we include CEO traits, such as gender, tenure, legal background, military service and educational background. The robustness results are consistent with the baseline findings. Moreover, Mannheim (1970) observed that childhood is the time when long-lasting impressions are formed, particularly those remembered from early-life disaster experiences. Thus, we test whether CEOs with disaster experiences during childhood are more imprinted in the baseline. We identify CEOs with child disaster experience who experience disaster from age 5 to 10. We prove that even CEOs with disaster experiences during childhood do not impact on corporate misconduct.

Our study makes various contributions. First, we contribution adds to the recent literature on behaviour of CEOs with early-life disaster experiences. This literature has mainly shed light on how firms with CEOs who have early-life disaster experiences impact corporate misconduct. For example, Bernile et al. (2017) reveal that CEOs with early-life disaster experience can affect firm acquisitions, leverage, cash holdings, and stock returns. Furthermore, O'Sullivan et al. (2021) discovered that CEOs who experience disasters in their early lives are more likely to take responsibility for the company. Chen et al. (2021) also observe that companies led by such CEOs have a greater risk of stock price crashes. In this study, we take it a step further by exploring whether firms' misconduct behaviour is influenced by CEOs' ability to recover from trauma during their formative years. To the best of our knowledge, this study is the first to investigate the influence of CEO conduct on corporate wrongdoing. Furthermore, the research expands on the CEOs behaviour influence topic by examining the impact of CEO behaviour on corporate misconduct specifically. Previous studies have predominantly focused on how boards affect corporate misconduct (e.g., Zaman et al. 2013). The influence of individual CEO behaviour on corporate misconduct remains an uncharted area.

The chapter is organised as follows. Section 4.2 provides a literature review and hypothesis development. Section 4.3 outlines the procedure for selecting the sample, describes the variables and research design. Section 4.4 presents the main findings as well as endogeneity and robustness tests. Finally, Section 4.5 offers concluding remarks.

## 4.2 Literature Review and Hypothesis Development

### *4.2.1 Corporate Misconduct*

Economic agents commit crimes when the rewards of their behavior outweigh the costs (Becker, 1968). There are several costs to a firm's misconduct. Paying fines and settling lawsuits are the most obvious costs of corporate misconduct behaviors (Muoghalu et al. 1990). Reputational penalties are the most significant cost of corporate misconduct behavior (Karpoff, 2012). In addition, the cost of new monitoring procedures must be implemented to guarantee that misconduct does not occur again (Karpoff et al. 2008).

Previous research has taken different views on how CEOs deal with misconduct. One view is that CEOs will not engage in misconduct. CEOs are associated with sanctions if their misconduct is discovered. The sanctions include the possibility of job loss, fines, and imprisonment (Karpoff et al. 2008). Another cost of the misconduct behavior is contractual lawsuits against the firm, which are likely to lead to CEO turnover (Aharony et al. 2015). However, an alternative view is that CEOs engage in misconduct for their own benefit. The performance evaluation of CEO promotion tournaments increases the likelihood of CEO misconduct (Hass et al. 2015). Khanna et al. (2015) report that the connections made by CEOs through the appointment of executives and directors increase the risk of corporate misconduct. By contributing to the cover-up of misconduct, the likelihood of the CEO's misconduct being discovered is reduced. This reduces the likelihood that the CEO will be dismissed.

Several studies explore how different situations influence firm misconduct behavior. For instance, Alexander and Cohen (1999) provide evidence that corporate misconduct is less

prevalent when management has a greater ownership stake. Kim et al. (2012) discovered that companies with a poorer corporate culture are more inclined to participate in financial misconduct. Chan et al. (2015) report on the effectiveness of offering cash and severance bonuses to CEOs in reducing the likelihood of misconduct. Moreover, research indicates that high-pressure work environments may lead to misconduct among executives. For example, Heese and Pérez-Cavazos (2020) discovered that companies facing substantial pressure are more prone to engage in unethical behavior. Leone and Rock (2002) also demonstrate that local managers tend to ignore regulations and rules when under pressure.

### *4.2.2 Early-life Experience*

Early-life experiences can have a significant impact on development over the course of a lifetime (Maniam et al. 2014). For example, Cohen et al. (2006) conducted research on 265 healthy Australian men and women without psychopathology or brain disorders and found that early life stress (ELS), defined as severe adversity (e.g., domestic violence, caregiver drug use) and severe relational poverty (e.g., caregiver neglect, lack of caregiver attunement), is linked to adult psychopathology and may contribute to long-term brain alterations. The anterior cingulate cortex (ACC) and caudate volumes are smaller in people who have experienced early life stress (ELS). Further evidence suggests that early-life stress (ELS) increases the likelihood of developmental and mental health issues later in life (Hambrick et al. 2019). According to psychological studies, early traumatic experiences leave more pronounced and long-lasting imprints on people (Cryder et al. 2006; Duran, 2013). For example, Cryder et al. (2006) apply the posttraumatic growth model (PTG), which first came up by Calhoun and Tedeschi (1998), to prove that traumatic experiences are more impressionable by exploring children who experienced Hurricane Floyd and the subsequent flooding. Additionally, Duran (2013) presents a narrative synthesis of empirical studies outlining how paediatric cancer survivors and their families are long-term impacted by the disease. Similarly, neuroimaging research also proves

that early traumatic experiences leave more pronounced and long-lasting imprints on people. A neurological imprint on the prefrontal cortex (PFC) is linked to the long-lasting psychological impact of traumatic situations (Lyoo et al. 2011). The PFC becomes highly activated during the cognitive processing of traumatic experiences because it is essential for how people manage and react to stress (Cerqueira et al. 2008; Nakagawa et al. 2016). Greater thickness (or volume of linked neurons) of the dorsolateral PFC has been seen in trauma survivors compared to control subjects, suggesting that traumatic experiences leave lasting neurological signs (Lyoo et al. 2011).

Natural disasters, such as hurricanes, earthquakes, and floods, can have a significant impact on the mental health and well-being of individuals, particularly when experienced during early life. Research has shown that early-life disaster exposure is associated with an increased risk of developing mental health conditions, such as post-traumatic stress disorder (PTSD), depression, and anxiety (Cryder et al. 2006; Duran, 2013). An increasing body of economic research offers strong evidence that people who suffer disaster events experience long-lasting changes in their risk choices (Callen et al. 2014). According to some studies, traumatic events in the past led to a more conservative risk attitude. For example, Malmendier and Nagel (2011) discovered that Depression deters people from investing in the stock market, so CEOs who experience Depression simply have a preference for self-sufficiency. As a result, Depression CEOs are more debt (and equity) conservative than their counterparts. Cameron and Shah (2015) found that people who have experienced a natural disaster are less inclined to accept financial risks in incentivized risk game experiments than residents without such experience. Using data from the U.S. Health and Retirement Survey, Bucciol and Zarri (2013) found a link between negative experiences and higher levels of risk aversion as measured by the likelihood of owning risky assets and the proportion of wealth invested in those assets. However, other research indicates that traumatic experiences in the past may have increased risk tolerance.

When put in a dangerous situation, a person prefers to compare this situation with a less terrifying traumatic event experience (Ben-Zur and Zeidner, 2009). This kind of comparison minimises the sense of loss connected to taking chances and raises a person's predisposition to do so (Taylor and Lobel, 1989). For instance, Eckel et al. (2009) discovered that women in their sample were considerably more risk-loving after the disaster experience when they looked at the risk preferences of a sample of storm Katrina survivors.

### *4.2.3 CEO early-life Disaster Experience and Corporate Misconduct*

The theory of the upper echelons (Hambrick and Mason, 1984) contends that earlier experiences have a lasting impact on a firm's top executives' cognition and values, which influence a firm's behaviour (Bertrand and Schoar, 2003). Based on the upper echelons theory, a growing body of studies focused on the effects of early encounters in executives' careers (Jung and Shin, 2019; Marquis and Qiao, 2020). Additionally, a wealth of psychological literature points to early life as the primary source of imprints that shape cognition and behaviour in adulthood (Elder, 2018; Mannheim, 1970). The impact of early-life disaster experiences on individuals can extend far beyond childhood and adolescence, and can also affect individuals in leadership positions, such as CEOs. For example, O'Sullivan et al. (2021) found that CEOs who experience early-life disasters would be more reliant on others and would improve the corporate social performance of their companies. Chen et al. (2021) use a longitudinal sample of U.S. companies to show that firms with CEOs who have early-life disaster experience are more likely to have stock price crashes. Stock price crashes occur because a CEO with early-life disaster experience is more risk tolerant and hence more likely to take the dangers connected with hoarding bad news, which leads to the risk of a stock price crash (Chen et al. 2021). Similarly, Bernile et al. (2017) found that those CEOs with "moderate" exposures to disaster-related fatalities are more likely to be tolerant of firm risk-taking: they

are more likely to engage in acquisitions; their firms hold more debt and less cash as a percentage of assets, and their stock returns are more volatile.

Existence theories concerning the association between CEO early-life disaster experience and firm violations yield contrasting views. On the one hand, according to risk-taking theory, CEOs with early-life disaster experience might lead to increased corporate misconduct. Traumatic experience diminishes the perception of loss linked with risk-taking and amplifies an individual's confidence in their ability to deal with risky situations, rendering them more risk-tolerant (Taylor and Lobel, 1989; Aldwin, 2007). Eckel et al. (2009) study provides evidence that traumatic events enhance individual risk tolerance by examining the risk preferences of a sample of Hurricane Katrina evacuees shortly after relocation to Houston and re-examining a year later. Voors et al. (2012) discovered that individuals who experienced violence tend to take more risks. Page et al. (2014) study provides evidence for the predictions of prospect theory regarding the adoption of a risk-seeking attitude following a loss. CEOs with greater risk-taking equity incentives are more inclined to apply pressure on employees, resulting in longer working hours, violations of labor laws, and health and safety regulations (Heese and Pérez-Cavazos, 2020). Although these actions are risky, they may enhance productivity and performance, and ultimately, raise the stock price (Chircop et al. 2020). Thus, high risk-taking CEOs may manipulate misconduct behavior to achieve benefits. This viewpoint implies that firms managed by CEOs who have experienced early-life calamities tend to display misconduct behavior on average.

*Hypothesis 1a: CEOs with early-life disaster experience would increase corporate misconduct.*

From another perspective, the responsibility-enhancing theory proposes that CEOs with early-life disaster experience would mitigate corporate misconduct. In accordance with the agency theory, executives and stakeholders have divergent interests (Jensen and Meckling, 1976). Shareholders benefit from the growth of the company and an increase in share prices.

Meanwhile, executives' remunerations entail more intricate provisions. Sometimes, managers engage in misconduct for personal gain, thereby causing harm to shareholder interests (Chircop et al. 2020). Tedeschi et al. (1998) document that in the face of natural disasters, people come together to overcome the crisis and maintain strong relationships. Thus, a heightened commitment to close partnerships arises from recognizing personal vulnerability and dependence on others in the aftermath of a traumatic event during the recovery process. Psychological studies further prove that individuals who have suffered trauma tend to shoulder greater social responsibility (see Staub and Vollhardt, 2008; Zoellner and Maercker, 2006). Specifically, individuals with prior experience of natural disasters in their early years would form a strong interpersonal bond and assume greater responsibility for others. Additionally, Narvaez et al. (2019) discovered that children's early life experiences have a significant impact on their wellbeing, moral development, and engaged moral orientation. In particular, their research demonstrated that childhood experiences with pain directly influence subsequent prosocial behaviors, and individuals with higher moral standards and ideologies tend to be less self-centered and more socially focused in their behavioral decisions. Furthermore, the impact of early-life experiences on individuals' moral development is also evident in the aspect of conscience (Berkowitz and Grych, 1998). As argued by Berkowitz and Grych (1998), early-life experiences shape moral standards and behavior codes, which in turn promote ethical oversight and alertness. This is manifested not only in regulating one's own behavior but also in monitoring others' misbehavior. Therefore, CEOs with early-life disaster experiences focus on the stakeholders' benefits and prefer to monitor immoral behavior.

*Hypothesis 1b: CEOs with early-life disaster experience would decrease corporate misconduct.*

## 4.3 Data

### *4.3.1 Sample Selection and Data Sources*

CEO data is acquired from various sources. The Standard & Poor's (S&P) ExecuComp database encompasses companies listed on the S&P 500, S&P 400 mid-cap, and S&P 600 small-cap indices. The database contains information on a majority of publicly traded American companies as well as multiple medium and small entities. The ExecuComp database holds a plethora of corporate data and executive compensation details. Consequently, we obtained initial information on CEO profiles through ExecuComp. We retrieved the birth and childhood location information of CEOs from various sources including Bloomberg, NNDB (The Notable Names Database), official company websites, and online resources such as encyclopedias and Wikipedia. In circumstances where the aforementioned sources failed to provide the necessary information, We consulted the Google search engine to obtain the executive's biographical details.

Information on natural disasters is sourced from various reliable websites and databases such as the U.S. National Geophysical Data Centre (NGDC), the U.S. Geological Survey (USGS), the National Weather Service (NWS) of the National Oceanic and Atmospheric Administration, the U.S. National Climatic Data Centre (NCDC), Spatial Hazard Events and Losses Database for the United States (SHELDUS™), and online resources (primarily Wikipedia).

Financial misconduct attracts penalties, causing a direct cost for the firms. Data on corporate misconduct comes from the Violation Tracker database compiled by Good Jobs First's Corporate Research Project and used in recent studies (Neukirchen et al. 2022; Xu et al. 2023). Violation Tracker has collated over 310,000 civil and criminal cases from more than 40 federal regulatory bodies since 2000. This database contains comprehensive records of corporate violations that incurred penalties of at least £5,000 and were associated with eight major categories of offenses. These include competition, consumer protection, employment,

environment, financial, government contracting, healthcare, and safety-related offenses. Safety-related offenses are the most frequent, with over half of all violations being accounted for by this type of offense, followed by environment-related and employment-related violations.

### *4.3.2 Dependent Variable: Corporate Misconduct*

As documented by Zaman et al. (2021), previous research on corporate misconduct has primarily focused on management actions that negatively impact shareholders. Specifically, numerous studies have concentrated on financial misreporting (Armstrong et al. 2013; Beasley et al. 2000), accounting irregularities (Armstrong et al. 2010), and financial market manipulations (Cumming et al. 2018). In this investigation, we probe into corporate misconduct by quantifying financial penalties imposed on companies for breaching stakeholder interests. We adhere to previous studies and provide a precise and neutral analysis of corporate malfeasance. First, we match the Violation Tracker with Compustat at the parent company-year level by comparing the company name given in Compustat to the reporting date parent name of the company given in Violation Tracker. Then, for firm-year observations not included in the Violation Tracker dataset, we set the penalty for violations in that year to zero. My measure of corporate conduct is calculated by taking the natural logarithm of one added to the sum of penalties charged to a company for violating all of the offense groups within a fiscal year. Additionally, we utilize the natural logarithm of one plus the count of a company's violations in a given year as a measure of corporate misconduct. Moreover, we tested the robustness of my results by applying a binary variable for violations. This variable equal one if a company has been recorded as violating regulations in a given year; otherwise, it is zero. In our study, all the corporate misconduct is used for one year lead as the dependent variable.

### *4.3.3 Independent Variables: CEO Early-life Disaster Experience*

Following Bernile et al. (2017), CEOs with early-life disaster experience are defined as individuals who experienced a natural disaster between the ages of 5 and 15 in their childhood

county. This age range is considered crucial for the development of enduring childhood memories and early adolescent growth (Nelson, 1993; Gathercole et al. 2004). The research solely focuses on natural disasters that occurred during the aforementioned age range. We initial have identified 8,808 unique CEOs between 1992 and 2020 using ExecuComp. We gathered birthplace, birth year, childhood location, education, and other biographical data for every CEO through Bloomberg, NNDB, company websites, and other credible sources. This approach helped us pinpoint the precise childhood location of 1,839 CEOs. For the CEOs whose childhood location was not confirmed, we followed Bernile et al. (2017) and used the birthplace as a proxy. Ultimately, we identified 2,072 CEOs who had a confirmed childhood location or birthplace.

Next, we identify natural hazards that took place in the childhood county of each CEO during their formative years. Consistent with previous research (Bernile et al. 2017; Chen et al. 2021; O'Sullivan et al. 2021), we utilize these hazards as a measure of a CEO's experience with early-life disasters. The disasters included earthquakes, volcanic eruptions, tsunamis, hurricanes, tornadoes, severe storms, floods, landslides, extreme temperatures, and wildfires. Our research explores previous incidences of disaster in the CEO's grow up county during their developmental years. Building on previous research (Bernile et al. 2017; Chen et al. 2021; O'Sullivan et al. 2021), we consider natural disasters as a CEO's early-life disaster experience. Natural hazards such as earthquakes, floods, hurricanes, tornadoes, tsunamis, volcanic eruptions, and wildfires are collated at the county level. A disaster's time frame starts from 1900 as the chief executives were born after that year. We manually gather disaster data from reliable sources such as the United States Geological Survey (USGS) and the National Geophysical Data Center (NGDC) for earthquakes and floods. Tsunami data is obtained from the NGDC website, whilst hurricane and tornado data are gathered by the National Climatic Data Centre (NCDC) and the National Weather Service (NWS) under the National Oceanic

and Atmospheric Administration. The wildfire data is primarily sourced from Wikipedia. Additional web searches and the use of the Spatial Hazard Events and Losses Database for the United States (SHELDUS™) were conducted to verify details for all disaster events. The time frame for disasters commences in 1900, as all CEOs were born following this year.

The CEO's early-life disaster experience variable is assigned a value of 1 if they experienced at least one disaster in their county of childhood between the ages of 5 and 15, and 0 otherwise.

### *4.3.4 Control Variables*

Following the Zaman et al. (2021) study, when examining the link between early-life disasters experienced by CEOs and corporate misconduct, we control for variations in several firm attributes such as return on assets (*ROA*), asset tangibility (*PPE*), company size (*SIZE*), capital expenditure (*CAPEX*), leverage (*LEV*), research and development expenses (*R&D*), market-to-book ratio (*MB*), and firm age (*FIRM_AGE*). Moreover, we control for year and industry (based on the SIC 2-digital industry code) in the analysis to eliminate potential differences and changes in the reliance on a particular firm misconduct over time and across industries. Further, we add the CEO's birth year and the grow-place fix effect to eliminate any potential cohort-related effects. The variables are delineated in Appendix A[25].

### *4.3.5 Descriptive Statistics*

From this sample, we exclude companies with incomplete financial data. Moreover, financial institutions and utilities have distinct financial features compared to those of other industries. Therefore, we exclude financial firms (SIC codes 6000 to 6900) and regulated utilities (SIC codes 4900 to 4949). All variables in this study are winsorized at the 1 percent and 99 percent levels to avoid any potential problems with outliers. The procedure led to a sample of 4,455 firm-year observations from 544 firms listed in the US and featuring 708 CEOs, spanning 2001-

[25] Board composition is shown to impact propensity for misconduct (see Arnaboldi et al. (2021). Our study does not consider the impact of board composition because the board composition data of firms with CEO information is limited.

2020. In our sample, 80 CEOs had early-life disaster experience, a proportion of 11.30%. Summary statistics for the variables are shown in Table 4.1. Table 4.1 shows that the mean value of *CEODIS* is 0.117, suggesting that 11.7% of the firm-level observations in the sample have CEOs with early-life disaster experience. On average, the raw value mean before log transformation indicates that there are 3.17 penalties and a total penalty amount of $15 million[26]. On average, firms generate a 0.049 return on assets (ROA), with a median of 0.046. Property, Plant, and Equipment (PPE) constitute around 0.317 of total assets on average, with a median of 0.26. Capital Expenditures (CAPEX) average 5.635 of total assets, with a nearly identical median, suggesting a balanced distribution. Leverage (LEV) averages 0.269, with a median of 0.258, showing that debt financing is consistent across firms. Cash holdings (CASH) average 0.109, but the median is lower at 0.065, indicating some firms hold significantly more cash. Research and Development (R&D) expenditures are minimal, with a mean of 0.017 and a median of 0, reflecting the fact that many firms do not invest heavily in R&D. The Market-to-Book ratio (MB) averages 1.866, with a median of 1.482, showing that firms are generally valued higher by the market than their book value. The average profit of the firms is 0.049. In our sample, the firms have an average size of 9.084 and an average age of 35.581 years, indicating that they are large and well-established. This is reasonable, as most of the CEOs for whom we can gather information work in Fortune 500 companies.

**[Insert Table 4.1 Here]**

### *4.3.6 Research design*

To test whether the CEOs with early-life disaster experience are related to corporate misconduct, we primarily estimate the following regression model:

[26] We also report the summary statistics for the different types of violations. In our sample, safety-related violations account for the majority. The raw value mean before log transformation indicates 2.69 penalties, with a total penalty amount of $15.4 million. The table of summary statistics is presented in Appendix B, and the regression results for the different violation types are shown in Appendix C.

$$Corporate\ Misconduct_{i,t+1} = \beta_0 + \beta_1 CEODIS_{i,t} + \beta_2 ROA_{i,t} + \beta_3 PPE_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 CAPEX_{i,t} + \beta_6 LEV_{i,t} + \beta_7 CASH_{i,t} + \beta_8 R\&D_{i,t} + \beta_9 MB_{i,t} + \beta_{10} FIRM\_AGE_{i,t} + \sum FE + \varepsilon_{i,t} \quad (1)$$

where $i$ denotes the firm, $t$ denotes the year. $\sum FE$ denotes industry fixed effects based on SIC 2-digital industry codes, year fixed effects CEO birth year fix effects and CEO grow up place fix effects. The $\varepsilon_{i,t}$ is the error term. We estimate the equation using ordinary least squares (OLS). The standard errors are clustered at firm level. $Corporate\ Misconduct_{i,t+1}$ refers to number of penalties ($NUM_{t+1}$) or total amount of penalties ($AMOUNT_{t+1}$). $CEODIS_{i,t}$ is the variable of interest and refers to CEO with early-life disaster experience or not. If the $Corporate\ Misconduct_{i,t+1}$ the estimated coefficient $\beta_1$ is positive, which suggests that firms with CEO experience of early-life disasters will increase firm violation, and vice versa.

## 4.4 Results

### *4.4.1 Baseline Results*

In this section, we investigate the causal effect of CEO early-life disaster experience on firm violation. We estimate Eq. (1) with standard errors adjusted for firm clustering. Table 4.2 presents the results of the baseline test estimation. The estimate of the coefficient of the CEO with prior disaster experience is shown in columns (1) and (2) of Table 4.2. The result of columns (1) and (2) shows that the coefficient of *CEODIS* in the regression is negative, suggesting that the number and total amount of penalties of firms decrease when the firm is led by CEOs with early-life disaster experience. Both are not statistically significant. In addition, following previous studies (Zaman et al. 2021), we include the firm's return on assets (*ROA*), tangibility (*PPE*), size (*SIZE*), capital expenditure (*CAPEX*), leverage (*LEV*), cash holdings (*CASH*), research and development expenditure (*R&D*), market-to-book ratio (*MB*) and firm age (*FIRM_AGE*) as control variables. The results are displayed in columns (3) and (4) of Table 4.2. There is still no strong evidence to prove that CEO with early-life disaster experience impact on corporate misconduct. The coefficients of columns (3) and (4) are -0.177 and -0.613,

with t-statistics of -1.79 and -0.81, respectively. In column (3), a coefficient of -0.177 on *CEODIS* implies that one standard deviation increase in *CEODIS* is associated with 7.2% ($= -0.177 * 0.322/0.792$) decrease in the number of violations relative to the mean. Similarly, column (4) implies that one standard deviation increase in *CEODIS* is associated with a 0.8% ($= -0.177 * 0.322/7.244$) decrease in the total amount of violations. In the baseline regression estimation, firm size, capital expenditures, and R&D intensity emerge as significant predictors of corporate misconduct. Larger firms and those with higher capital expenditures are more likely to incur violations and face larger penalties, possibly due to greater operational complexity and scrutiny. In contrast, firms with higher R&D intensity tend to have fewer violations and lower penalties, suggesting that a focus on innovation may reduce the likelihood of misconduct. Other control variables, such as ROA, PPE, leverage, cash holdings, market-to-book ratio, and firm age, show varying relationships with corporate misconduct, but their effects are generally less pronounced.

**[Insert Table 4.2 Here]**

### *4.4.2 Endogeneity Issues*

The results may be affected by unobserved variables that affect the debt structure and the probability of a CEO with early disaster experience joining the target firm. To address this, we conduct matched sample tests. First, we use propensity score matching (PSM) to control for such concerns. Propensity score matching (PSM) generates a propensity score, which indicates the probability of a unit with certain characteristics being assigned to the treatment group as opposed to the control group. By matching variables in the treatment and control groups, these scores can be used to remove selection bias in observational research. For the purposes of the PSM analysis, we have defined the treatment group as firms with CEOs who have previous disaster experience. The control group consists of companies whose CEOs did not experience disasters in their early lives. In the PSM procedure, we first perform one-to-one matching by

estimating propensity scores using a logit approach. The independent variable is *CEODIS* and the matching variables are firm characteristics, including return on assets (*ROA*), tangible assets (*PPE*), firm size (*SIZE*), capital expenditure (*CAPEX*), leverage (*LEV*), research and development expenditure (*R&D*), market-to-book ratio (*MB*) and firm age (*FIRM_AGE*). I repeat the regression analysis by matching each firm led by a CEO with early disaster experience to another firm led by a CEO without early disaster experience, using the closest matching score. The results, presented in Table 4.3, consistently show that there is no significant evidence support CEO with early-life disaster experience impact on corporate misconduct.

**[Insert Table 4.3 Here]**

Furthermore, we applied entropy balancing to ascertain a causal correlation between CEOs who have experienced disasters in early life and instances of corporate misconduct. Entropy balancing is a technique for equating treatment and control groups, adapted from Hainmueller (2012), that generates a set of matching weights based on the attributes of the treatment and control groups. Similar to propensity score matching (PSM), first calculate matching weights based on firm characteristics (*ROA*, *PPE*, *SIZE*, *CAPEX*, *LEV*, *R&D*, *MB*, and *FIRM_AGE*) in the treatment group (firms led by CEOs with early-life disaster experience) and control group (firms led by CEOs without early-life disaster experience). Then conduct the regression again with adjusted weights. The results presented in Table 4.4, after entropy balancing matching, consistently show that there is no noteworthy evidence to suggest that CEOs with early-life disaster experience have any impact on corporate misconduct.

**[Insert Table 4.4 Here]**

To further evaluate the causal impact of a CEO's early-life disaster experience on debt structure, we used CEO turnover events. The CEO turnover events are identified based on CEO change in the ExecuComp database (Chen et al. 2021). Following a previous study (Eisfeldt and

Kuhnen, 2013), if a different person held the position of CEO in the current year and the following year, we can determine when the CEO was replaced. We record this as a CEO turnover event for year t if the CEO's name in year t and year $t+1$ are different. The CEO turnover events that I record consist of exogenous and forced turnover events. To test the CEO turnover events impact, we applied the Difference-in-Differences (DiD) method. To conduct the test, we create a treatment group consisting of firms that experienced CEO turnover events. After applying these criteria, we identified 121 incidents of CEO turnover and 29 events where the firm's CEO risk attitude changed. Control firms are those firms that have not experienced CEO turnover events in the same period. We estimate DiD using the following regression model:

$$Corporate\ misconduct_{i,t+1} = \beta_0 + \beta_1 CEODIS_{i,t} + \beta_2 TREAT_{i,t} + \beta_3 CEODIS * TREAT_{i,t} + \beta_4 ROA_{i,t} + \beta_5 PPE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 CAPEX_{i,t} + \beta_8 LEV_{i,t} + \beta_9 CASH_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} MB_{i,t} + \beta_{12} FIRM\_AGE_{i,t} + \sum FE + \varepsilon_{i,t} \quad (2)$$

where $i$ denotes the firm, $t$ denotes the year. $\sum FE$ denotes industry fixed effects based on SIC 2-digital industry codes, year fixed effects CEO birth year fix effects and CEO grow up place fix effects. The $\varepsilon_{i,t}$ is the error term. The standard errors are clustered at firm level. $Corporate\ Misconduct_{i,t+1}$ refers to number of penalties ($NUM_{t+1}$) or total amount of penalties ($AMOUNT_{t+1}$). $CEODIS_{i,t}$ refers to CEO with early-life disaster experience or not. $CEODIS * TREAT_{i,t}$ is the interactive variable that we are interested in. $TREAT_{i,t}$ is the index equal to 1 if a firm has CEO turnover events as I discussed above; otherwise, it is 0.

Notably, Table 4.5 results show that the coefficient estimate for the interaction term $CEODIS * TREAT_{i,t}$ is insignificant. The estimated coefficients are −0.124 and -0.301, with t-statistics of −1.32 and 0.44 for $NUM_{t+1}$ and $AMOUNT_{t+1}$, respectively. The result of columns suggests that the change in corporate misconduct due to CEO risk attitude changes in firms is insignificantly from the pre-CEO turnover events to the post-CEO turnover events period.

**[Insert Table 4.5 Here]**

### *4.4.3 Robustness Tests*

In this section, a range of robustness tests are conducted, beginning with an alternative method of measuring corporate misconduct. The binary variable $VIONALTION_{t+1}$ is utilised, whereby a value of 1 is assigned if a firm incurs penalties during the specified year and 0 otherwise[27]. The resulting coefficients are displayed in column (1) of Table 4.6 and show a value of -0.151 along with statistically insignificant t-statistics. The primary results are corroborated by the findings, suggesting that there is no substantial evidence to support CEO impact on corporate misconduct linked to early-life disaster experience.

Additionally, a subsample test as a robustness test to check main results reported in Table 4.3. The sample consisted of 708 CEOs' information collected from 50 states, with a total of 4455 observations. The majority of the sample came from the states of New York (684), Pennsylvania (302), and Ohio (294). By replicating the main tests and excluding firms with CEOs from the top three states, we can determine whether the results are predominantly driven by the majority of states. The outcomes can be found in columns (2) and (3) of table 4.6. The estimated values for columns (2) and (3) are -0.092 and -0.150, correspondingly, with no statistically significant t-statistics.

Furthermore, adjust for various CEO attributes recommended in previous research (Cronqvist et al. 2015), incorporating CEOs' gender (*MALE*), length of service (*TENURE*), legal training (*LAW*), military service (*MILITARY*) and education background (*EDUCATION*). The CEO gender (*MALE*) variable takes the value of one if the CEO is male and zero if the CEO is female. CEO tenure (*TENURE*) is defined as the number of years between the fiscal year and the year in which the CEO assumed the position. The CEO law background (*LAW*) variable equals one

[27] There is often a time lag between the occurrence of misconduct and the resulting penalty. Future studies could consider incorporating additional lags or time windows to better capture this effect (see Casu et al. (2023)).

if the CEO holds a JD or LLD degree and zero otherwise. The indicator of military service (*MILITARY*) is equal to one if the CEO service in the military and zero otherwise. The indicator of education background (*EDUCATION*) is set at one if the CEO possesses a bachelor's degree, two if they possess a master's degree, and three if they hold a PhD. Otherwise, the indicator is zero. The findings are presented in columns (4) and (5) of table 4.6. The results of all the robustness tests demonstrate that companies headed by a CEO who has experienced a disaster early in life would not notably increase or decrease corporate misconduct.

**[Insert Table 4.6 Here]**

### *4.4.4 Childhood Memory*

As psychological development occurs, children's personality traits become more stable as they approach puberty (Caspi et al. 2005). Consequently, CEOs who were exposed to disasters during their childhood are likely to experience more adverse effects when compared to those who experienced the same events during their adolescence. To test this hypothesis, we assign *CEODISCHILD* as "1" if the CEO underwent early-life disasters between the ages of 5 and 10 or as "0" otherwise. Regression analysis was conducted on both the total number ($NUM_{t+1}$) and amount of violations ($AMOUNT_{t+1}$), controlling other variables. Table 4.7, Columns (1) and (2), provide the results of this study. The estimated coefficients are not significant. One standard deviation increase in *CEODISCHILD* led to a 5.53% ($= -0.156 * 0.281/0.792$) decrease in the number of violations and a 4.15% ($= -1.07 * 0.281/7.244$) decrease in the total amount of violations. Thus, the regression results indicate that CEOs who experienced childhood disasters would not have an impact on corporate violations.

**[Insert Table 4.7 Here]**

## 4.5 Conclusion

Theoretically, CEOs who have experienced disasters early in life may have a positive or negative impact on corporate misconduct. Nonetheless, after examining a longitudinal sample

of US companies, there is no compelling evidence to suggest that, on average, firms overseen by CEOs with such experiences have any influence on corporate misconduct.

To support the primary outcomes, three approaches were employed to tackle the endogeneity issue. Firstly, we employed propensity score matching (PSM), followed by the re-run of the baseline regression using matched samples. Secondly, the entropy balance approach was used to acquire matched samples, and it was uncovered that the results continued to support the main conclusions. Finally, we utilised the differences-in-differences method to study the changes in corporate misconduct following different CEO risk preferences based on CEO turnover events. The results of the test confirm that there is no causal link between a CEO's experience of disasters in their early life and incidents of corporate misconduct.

We conducted three robustness tests to reinforce my findings. Firstly, we employed different gauges of corporate misconduct. The novel dependent variable is a binary factor, equating to 1 when a company breaches regulations in a given year, and 0 if not. Secondly, to diminish cluster impact, we excluded the highest three US states by CEO count. Thirdly, we augmented the results with further CEO traits as control variables. Theoretically, childhood experience would be more imprinted, however, our study does not find strong evidence to support this theory.

Our study contributes to works of literature focusing on the influence of CEOs with early-life disaster experiences on corporate misconduct in firms. Early-life experience alters CEO behavior, which further affects their misconduct behavior. For instance, firms led by those CEOs may face more or less firm violations than other firms. However, in our study, there is insufficient evidence to support the claim that CEOs with early-life disaster experience impact corporate misconduct. These results imply that other factors may play a more crucial role in determining corporate misconduct, and focusing solely on CEOs' early-life experiences may overlook these critical elements.

## Appendix A. Variable definition

| Variable name | Variable definition | Source |
|---|---|---|
| *Dependent variables* | | |
| $NUM_{t+1}$ | The natural logarithm of one plus the number of violations of a company in a given year. | Violation Tracker |
| $AMOUNT_{t+1}$ | The natural logarithm of one plus the sum of penalties imposed on a firm due to violations related to all offense groups in a given year. | Violation Tracker |
| $VIOLATION_{t+1}$ | The binary variable equals one if the company violated regulations in a given year, and zero otherwise. | Violation Tracker |
| *Independent variables* | | |
| CEODIS | The indicator is equal to one if the CEOs with early-life disaster experience. | Manually collect |
| CEODISCHILD | The indicator is equal to one if the CEOs with disaster experience during age 5-10. | Manually collect |
| *Control variables* | | |
| ROA | Earnings before interest and taxes (EBIT) divided by total assets. | Compustat |
| PPE | Net property, plant, and equipment divided by total assets. | Compustat |
| SIZE | The natural log of total assets measured in millions of U.S. dollars. | Compustat |
| CAPEX | The natural logarithm of capital expenditure. | Compustat |
| LEV | The sum of long-term debt and debt in current liabilities divided by total assets. | Compustat |
| CASH | Cash and cash relevant at the end of the fiscal year divided by total assets. | Compustat |
| R&D | Research and development expenses divided by total assets. Replace research and development expense equal to 0 if that year is missing. | Compustat |
| MB | The market-to-book ratio = (total assets – common equity + price close * common shares outstanding)/total assets. | Compustat |
| FIRM_AGE | The natural log of one plus the number of years since the firm appears in Compustat. | Compustat |
| *Additional CEO characteristics* | | |
| AGE | The discrepancy between the fiscal year and the CEO's birth year. | Manually collect |
| MALE | The indicator is equal to one if the CEO is male and zero if the CEO is female. | ExecuComp |
| TENURE | The number of years between the fiscal year and the year in which the CEO assumed the position. | ExecuComp |
| LAW | The indicator is equal to one if the CEO holds a JD or LLD degree and zero otherwise. | Manually collect |
| MILITARY | The indicator is equal to one if the CEO service in the military and zero otherwise. | Manually collect |
| EDUCATION | The indicator is set at one if the CEO possesses a bachelor's degree, two if they possess a master's degree, and three if they hold a PhD. Otherwise, the indicator is zero. | Manually collect |

## Appendix B. Summary of violations by different types

| | | NUM t+1 | | | | | AMOUNT $_{t+1}$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | Observations | Mean | Median | 25% | 75% | Std.Dev. | Mean | Median | 25% | 75% | Std.Dev. |
| Competition-related offenses | 79 | 0.749 | 0.693 | 0.000 | 1.609 | 0.853 | 9.247 | 10.373 | 0.000 | 16.525 | 7.816 |
| Consumer-protection-related offenses | 194 | 1.154 | 1.099 | 0.693 | 1.609 | 0.844 | 10.620 | 11.836 | 8.748 | 15.608 | 6.489 |
| Employment-related offenses | 470 | 0.993 | 0.693 | 0.000 | 1.609 | 0.887 | 9.242 | 10.864 | 0.000 | 14.187 | 6.510 |
| Environment-related offenses | 695 | 1.190 | 1.099 | 0.693 | 1.792 | 0.900 | 9.997 | 11.009 | 8.887 | 13.635 | 5.733 |
| Financial offenses | 83 | 0.816 | 0.693 | 0.000 | 1.946 | 0.948 | 11.389 | 14.316 | 0.000 | 18.370 | 8.211 |
| Government-contracting-related offenses | 66 | 1.037 | 1.099 | 0.693 | 1.609 | 0.754 | 11.661 | 13.661 | 8.689 | 17.209 | 6.878 |
| Healthcare-related offenses | 16 | 1.088 | 1.099 | 0.693 | 1.609 | 0.621 | 12.973 | 15.188 | 9.861 | 16.647 | 6.108 |
| Miscellaneous offenses | 9 | 1.131 | 1.386 | 0.347 | 2.004 | 0.957 | 12.578 | 14.595 | 5.228 | 19.796 | 8.258 |
| Safety-related offenses | 2843 | 0.629 | 0.000 | 0.000 | 1.099 | 0.838 | 5.621 | 0.000 | 0.000 | 11.244 | 6.443 |

Note: This table shows the statistics of the sampled misconduct violations by type.

## Appendix C. Baseline results of violations by different types

| | NUM t+1 | | | | AMOUNT t+1 | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Variables | Consumer-protection-related offenses | Employment-related offenses | Environment-related offenses | Safety-related offenses | Consumer-protection-related offenses | Employment-related offenses | Environment-related offenses | Safety-related offenses |
| CEODIS | 0.269 | -0.653*** | 0.029 | -0.155 | -1.636 | -3.719* | 1.742 | -0.868 |
| | (0.66) | (-2.64) | (0.14) | (-1.29) | (-0.36) | (-1.82) | (1.21) | (-0.92) |
| ROA | -2.251 | -0.086 | -0.196 | -0.197 | 1.217 | -1.593 | 1.102 | -1.364 |
| | (-0.79) | (-0.10) | (-0.36) | (-0.89) | (0.05) | (-0.25) | (0.26) | (-0.69) |
| PPE | 2.457** | -0.195 | -0.263 | 0.097 | 27.308* | -1.486 | -2.555 | 0.423 |
| | (2.28) | (-0.44) | (-0.74) | (0.47) | (1.90) | (-0.42) | (-0.96) | (0.29) |
| SIZE | 0.132 | 0.231** | 0.181** | 0.065* | 3.793** | 1.531* | 1.138* | 0.528* |
| | (0.80) | (2.38) | (2.04) | (1.91) | (2.23) | (1.74) | (1.71) | (1.96) |
| CAPEX | 0.091 | 0.123 | 0.147* | 0.128*** | -1.453 | 0.637 | 0.916 | 1.027*** |
| | (0.77) | (1.36) | (1.75) | (4.16) | (-1.10) | (0.75) | (1.46) | (4.08) |
| LEV | 0.549 | -0.074 | -0.440 | 0.055 | 9.255 | -2.285 | -3.330 | 0.038 |
| | (1.03) | (-0.25) | (-1.35) | (0.45) | (1.57) | (-0.96) | (-1.46) | (0.04) |
| CASH | -1.520 | -1.364** | -0.593 | -0.127 | 0.964 | -8.112 | -0.560 | 0.155 |
| | (-1.53) | (-2.56) | (-1.09) | (-0.79) | (0.08) | (-1.59) | (-0.14) | (0.11) |
| R_D | -3.634 | -2.474 | -5.903*** | -1.827*** | -11.308 | 0.388 | -19.677 | -20.070*** |
| | (-0.53) | (-0.95) | (-3.60) | (-2.94) | (-0.15) | (0.02) | (-1.31) | (-3.61) |
| MB | -0.053 | 0.067 | -0.040 | -0.006 | -1.180 | -0.230 | -0.156 | -0.029 |
| | (-0.35) | (0.95) | (-0.65) | (-0.34) | (-0.92) | (-0.35) | (-0.33) | (-0.18) |
| FIRM_AGE | 0.029** | -0.004 | 0.004 | 0.004*** | 0.207 | 0.010 | 0.030 | 0.028*** |
| | (2.55) | (-0.94) | (1.05) | (2.89) | (1.40) | (0.38) | (1.48) | (2.69) |
| Observations | 167 | 446 | 682 | 2,840 | 167 | 446 | 682 | 2,840 |
| R-squared | 0.842 | 0.660 | 0.610 | 0.603 | 0.712 | 0.493 | 0.442 | 0.372 |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Birth_Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Growth_Place_State FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Note: This table presents the effect of CEOs' early-life disaster experiences on corporate misconduct by four different violation types. No results are reported for the other five violation types due to omitted independent variables. All variables are defined in Appendix A. The constant term, industry fixed effects based on 2-digit SIC codes, year fixed effects, CEO birth year fixed effects, and CEO hometown fixed effects are included in the regressions. The regressions are performed using an ordinary least squares (OLS) model. Standard errors are clustered at the firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

**Table 4.1 Descriptive statistics**

| Variables | Observations | Mean | Median | 25% | 75% | Std.Dev. |
|---|---|---|---|---|---|---|
| $NUM_{t+1}$ | 4,455 | 0.792 | 0.693 | 0.000 | 1.386 | 0.888 |
| $AMOUNT_{t+1}$ | 4,455 | 7.244 | 9.226 | 0.000 | 12.689 | 6.699 |
| $VIOLATION_{t+1}$ | 4,455 | 0.570 | 1.000 | 0.000 | 1.000 | 0.495 |
| CEODIS | 4,455 | 0.117 | 0.000 | 0.000 | 0.000 | 0.322 |
| CEODISCHILD | 4,455 | 0.086 | 0.000 | 0.000 | 0.000 | 0.281 |
| ROA | 4,455 | 0.049 | 0.046 | 0.020 | 0.084 | 0.066 |
| PPE | 4,455 | 0.317 | 0.260 | 0.119 | 0.503 | 0.239 |
| SIZE | 4,455 | 9.084 | 9.100 | 7.957 | 10.213 | 1.656 |
| CAPEX | 4,455 | 5.635 | 5.634 | 4.387 | 6.934 | 1.791 |
| LEV | 4,455 | 0.269 | 0.258 | 0.144 | 0.376 | 0.171 |
| CASH | 4,455 | 0.109 | 0.065 | 0.024 | 0.147 | 0.125 |
| R&D | 4,455 | 0.017 | 0.000 | 0.000 | 0.019 | 0.036 |
| MB | 4,455 | 1.866 | 1.482 | 1.167 | 2.113 | 1.109 |
| FIRM_AGE | 4,455 | 35.581 | 36.000 | 19.000 | 53.000 | 18.550 |

Note: This table provides the summary statistics. The Appendix A contains all variable definitions.

**Table 4.2 CEO with early-life disaster experience and corporate misconduct**

| | $NUM_{t+1}$ | $AMOUNT_{t+1}$ | $NUM_{t+1}$ | $AMOUNT_{t+1}$ |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| CEODIS | -0.135 | -0.326 | -0.177* | -0.613 |
| | (-1.07) | (-0.36) | (-1.79) | (-0.81) |
| ROA | | | -0.278 | -1.651 |
| | | | (-1.16) | (-0.86) |
| PPE | | | 0.083 | 0.373 |
| | | | (0.44) | (0.30) |
| SIZE | | | 0.099*** | 0.827*** |
| | | | (3.02) | (3.22) |
| CAPEX | | | 0.145*** | 1.051*** |
| | | | (4.94) | (4.47) |
| LEV | | | -0.015 | -0.495 |
| | | | (-0.12) | (-0.56) |
| CASH | | | -0.215 | -0.195 |
| | | | (-1.28) | (-0.15) |
| R&D | | | -2.356*** | -18.300*** |
| | | | (-3.42) | (-3.18) |
| MB | | | -0.008 | -0.163 |
| | | | (-0.41) | (-0.99) |
| FIRM_AGE | | | 0.003* | 0.025** |
| | | | (1.72) | (2.38) |
| Observations | 4,453 | 4,453 | 4,453 | 4,453 |
| R-squared | 0.448 | 0.448 | 0.566 | 0.386 |
| Industry FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Birth_Year FE | Yes | Yes | Yes | Yes |
| Growth_Place_State FE | Yes | Yes | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on corporate misconduct. All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. The regressions are performed by ordinary least squares (OLS) model. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 4.3 PSM results**

| Panel A: PSM match results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre-matching | | | | Post-matching | | | |
| | Treated | Control | Differences | t-statistics | Treated | Control | Difference | t-statistics |
| ROA | 0.043 | 0.041 | 0.002 | 0.36 | 0.043 | 0.050 | -0.008 | -2.54 |
| PPE | 0.314 | 0.316 | -0.002 | -0.16 | 0.314 | 0.318 | -0.004 | -0.38 |
| SIZE | 9.143 | 9.098 | 0.045 | 0.43 | 9.142 | 9.076 | 0.066 | 0.87 |
| CAPEX | 5.730 | 5.662 | 0.067 | 0.6 | 5.730 | 5.622 | 0.108 | 1.29 |
| LEV | 0.257 | 0.258 | 0.000 | -0.04 | 0.257 | 0.270 | -0.013 | -1.63 |
| CASH | 0.122 | 0.117 | 0.005 | 0.55 | 0.122 | 0.108 | 0.014 | 2.38 |
| R&D | 0.017 | 0.014 | 0.003 | 1.35 | 0.017 | 0.018 | -0.001 | -0.46 |
| MB | 1.835 | 1.846 | -0.011 | -0.16 | 1.835 | 1.871 | -0.036 | -0.69 |
| FIRM_AGE | 36.916 | 36.732 | 0.184 | 0.16 | 36.920 | 35.400 | 1.520 | 1.75 |

| Panel B: PSM regression results | | |
|---|---|---|
| | NUM t+1 | AMOUNT t+1 |
| Variables | (1) | (2) |
| CEODIS | -0.187 | -0.129 |
| | (-1.35) | (-0.12) |
| ROA | -0.123 | -2.068 |
| | (-0.31) | (-0.59) |
| PPE | -0.262 | 0.727 |
| | (-0.91) | (0.33) |
| SIZE | 0.043 | 0.481 |
| | (0.67) | (0.94) |
| CAPEX | 0.189*** | 1.224*** |
| | (3.67) | (2.92) |
| LEV | 0.290 | 2.312 |
| | (1.40) | (1.34) |
| CASH | -0.390 | 0.215 |
| | (-1.28) | (0.07) |
| R&D | -2.039 | -7.051 |
| | (-1.38) | (-0.57) |
| MB | -0.019 | -0.428 |
| | (-0.53) | (-0.98) |
| FIRM_AGE | -0.003 | -0.024 |
| | (-0.76) | (-1.11) |
| Observations | 1,029 | 1,029 |
| R-squared | 0.607 | 0.489 |
| Industry FE | Yes | Yes |
| Year FE | Yes | Yes |
| Birth_Year FE | Yes | Yes |
| Growth_Place_State FE | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on corporate misconduct based on propensity score matching (PSM). Panel A reports PSM match results. Panel B reports PSM regression results. All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 4.4 Entropy balance results**

| Panel A: Entropy balancing match results | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Before: Without weighting | | | | After: With weighting | | | |
| | Treated | Control | Difference | t-statistics | Treated | Control | Difference | t-statistics |
| ROA | 0.043 | 0.050 | -0.008 | -2.54 | 0.043 | 0.043 | 0.000 | 0.000 |
| PPE | 0.314 | 0.318 | -0.004 | -0.38 | 0.314 | 0.314 | 0.000 | 0.000 |
| SIZE | 9.142 | 9.076 | 0.066 | 0.87 | 9.142 | 9.142 | 0.000 | 0.000 |
| CAPEX | 5.730 | 5.622 | 0.108 | 1.29 | 5.730 | 5.730 | 0.000 | 0.000 |
| LEV | 0.257 | 0.270 | -0.013 | -1.63 | 0.257 | 0.257 | 0.000 | 0.000 |
| CASH | 0.122 | 0.108 | 0.014 | 2.38 | 0.122 | 0.122 | 0.000 | 0.000 |
| R&D | 0.017 | 0.018 | -0.001 | -0.46 | 0.017 | 0.017 | 0.000 | 0.000 |
| MB | 1.835 | 1.871 | -0.036 | -0.69 | 1.835 | 1.835 | 0.000 | 0.000 |
| FIRM_AGE | 36.920 | 35.400 | 1.520 | 1.75 | 36.920 | 36.910 | 0.010 | 0.000 |

| Panel B: Entropy balancing regression results | | |
|---|---|---|
| | NUM t+1 | AMOUNT t+1 |
| Variables | (1) | (2) |
| CEODIS | -0.215** | -1.014 |
| | (-2.05) | (-1.40) |
| ROA | -0.179 | -2.473 |
| | (-0.71) | (-1.21) |
| PPE | -0.204 | -0.038 |
| | (-0.86) | (-0.02) |
| SIZE | 0.080* | 0.743** |
| | (1.92) | (2.28) |
| CAPEX | 0.154*** | 0.975*** |
| | (4.41) | (3.54) |
| LEV | 0.053 | 0.651 |
| | (0.34) | (0.58) |
| CASH | -0.376** | -1.855 |
| | (-1.97) | (-1.15) |
| R&D | -2.478** | -12.646* |
| | (-2.50) | (-1.77) |
| MB | -0.016 | -0.347 |
| | (-0.69) | (-1.14) |
| FIRM_AGE | 0.002 | 0.022 |
| | (0.57) | (1.48) |
| Observations | 4,453 | 4,453 |
| R-squared | 0.561 | 0.432 |
| Industry FE | Yes | Yes |
| Year FE | Yes | Yes |
| Birth_Year FE | Yes | Yes |
| Growth_Place_State FE | Yes | Yes |

Note: This table presents the effect of CEO early-life disaster experience on corporate misconduct based on entropy balancing match. Panel A reports entropy balancing results. Panel B reports entropy balancing match results. All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 4.5 Changes in corporate misconduct around CEO turnover events**

| Variables | $NUM_{t+1}$ (1) | $AMOUNT_{t+1}$ (2) |
|---|---|---|
| CEODIS | -0.064 | 0.709 |
| | (-0.35) | (0.66) |
| TREAT | 0.242** | 0.557 |
| | (2.58) | (0.94) |
| CEODIS*TREAT | -0.124 | -0.301 |
| | (-1.32) | (-0.44) |
| ROA | -0.490 | -3.014 |
| | (-1.42) | (-1.02) |
| PPE | 0.050 | 1.092 |
| | (0.15) | (0.52) |
| SIZE | 0.102 | 1.387*** |
| | (1.61) | (3.38) |
| CAPEX | 0.156*** | 0.581 |
| | (2.75) | (1.57) |
| LEV | -0.169 | -1.580 |
| | (-0.70) | (-0.97) |
| CASH | -0.504 | -2.917 |
| | (-1.59) | (-1.24) |
| R&D | -3.704*** | -8.365 |
| | (-2.60) | (-0.76) |
| MB | -0.041 | -0.206 |
| | (-0.94) | (-0.67) |
| FIRM_AGE | 0.001 | 0.014 |
| | (0.32) | (0.62) |
| Observations | 1,770 | 1,770 |
| R-squared | 0.622 | 0.423 |
| Industry FE | Yes | Yes |
| Year FE | Yes | Yes |
| Birth_Year FE | Yes | Yes |
| Growth_Place_State FE | Yes | Yes |

Note: This table presents the difference-in-differences (DiD) regression results of changes in corporate misconduct around CEO turnover events during the study period from 2001 to 2020. All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 4.6 Robustness results**

| Variables | $VIOLATION_{t+1}$ (1) | $NUM_{t+1}$ (2) | $AMOUNT_{t+1}$ (3) | $NUM_{t+1}$ (4) | $AMOUNT_{t+1}$ (5) |
|---|---|---|---|---|---|
| CEODIS | -0.151 | -0.092 | -0.150 | -0.226** | -0.813 |
| | (-0.40) | (-0.86) | (-0.19) | (-2.02) | (-0.94) |
| ROA | -0.823 | -0.192 | -2.142 | -0.235 | -0.885 |
| | (-0.88) | (-0.70) | (-0.96) | (-0.95) | (-0.45) |
| PPE | 0.367 | -0.180 | -1.305 | 0.102 | 0.249 |
| | (0.64) | (-0.85) | (-0.92) | (0.49) | (0.18) |
| SIZE | 0.195* | 0.103*** | 0.699** | 0.088*** | 0.800*** |
| | (1.84) | (2.68) | (2.33) | (2.65) | (2.93) |
| CAPEX | 0.512*** | 0.154*** | 1.153*** | 0.143*** | 1.019*** |
| | (5.19) | (4.43) | (4.20) | (4.76) | (4.11) |
| LEV | -0.133 | 0.010 | 0.145 | 0.123 | -0.033 |
| | (-0.33) | (0.06) | (0.14) | (1.00) | (-0.04) |
| CASH | -0.780 | -0.391** | -0.149 | -0.190 | 0.077 |
| | (-1.34) | (-2.09) | (-0.10) | (-1.12) | (0.06) |
| R&D | -12.871*** | -2.398** | -18.225** | -2.034*** | -14.223** |
| | (-5.15) | (-2.31) | (-2.31) | (-2.75) | (-2.27) |
| MB | -0.047 | -0.007 | -0.177 | -0.002 | -0.121 |
| | (-0.59) | (-0.32) | (-0.96) | (-0.08) | (-0.67) |
| FIRM_AGE | 0.010** | 0.001 | 0.021* | 0.004* | 0.029*** |
| | (2.36) | (0.53) | (1.65) | (1.94) | (2.59) |
| MALE | | | | 0.072 | -0.634 |
| | | | | (0.61) | (-0.77) |
| TENURE | | | | -0.001 | 0.005 |
| | | | | (-0.28) | (0.22) |
| LAW | | | | 0.186** | 1.112** |
| | | | | (2.42) | (2.36) |
| MILITARY | | | | 0.117 | 0.106 |
| | | | | (1.25) | (0.19) |
| EDUCATION | | | | 0.011 | -0.081 |
| | | | | (0.36) | (-0.39) |
| Observations | 4,260 | 3,172 | 3,172 | 4,005 | 4,005 |
| Pseudo or R-squared | 0.278 | 0.601 | 0.408 | 0.566 | 0.388 |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Birth_Year FE | Yes | Yes | Yes | Yes | Yes |
| Growth_Place_State FE | Yes | Yes | Yes | Yes | Yes |

Note: This table presents the results of the robustness checks. Columns (1) shows the logit regression results of alternative dependent variable. Columns (2) and (3) report the results after deleting the top 3 U.S. states of the CEOs cluster. We add CEO others characteristic as controls in columns (4) and (5). All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

**Table 4.7 Childhood memory**

| | $NUM_{t+1}$ | $AMOUNT_{t+1}$ |
|---|---|---|
| | (1) | (2) |
| CEODISCHILD | -0.156 | -1.070 |
| | (-1.51) | (-1.42) |
| ROA | -0.290 | -1.723 |
| | (-1.21) | (-0.90) |
| PPE | 0.084 | 0.386 |
| | (0.44) | (0.31) |
| SIZE | 0.095*** | 0.806*** |
| | (2.93) | (3.15) |
| CAPEX | 0.149*** | 1.071*** |
| | (5.06) | (4.56) |
| LEV | -0.026 | -0.546 |
| | (-0.22) | (-0.62) |
| CASH | -0.206 | -0.166 |
| | (-1.23) | (-0.12) |
| R&D | -2.376*** | -18.201*** |
| | (-3.45) | (-3.17) |
| MB | -0.009 | -0.166 |
| | (-0.50) | (-1.00) |
| FIRM_AGE | 0.003 | 0.024** |
| | (1.61) | (2.34) |
| Observations | 4,453 | 4,453 |
| R-squared | 0.566 | 0.386 |
| Industry FE | Yes | Yes |
| Year FE | Yes | Yes |
| Birth_Year FE | Yes | Yes |
| Growth_Place_State FE | Yes | Yes |

Note: This table presents the results of the CEO with disaster experience during childhood age. All variables are defined in Appendix A. The constant term, industry fixed effects based on SIC 2-digital codes, year fixed effect, CEO birth year fixed effect and CEO grow up place fixed effect are included in the regressions. Standard errors are clustered at firm level and reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% probability level, respectively.

# Chapter 5: Thesis conclusion

This thesis comprises three empirical investigations within the realm of corporate finance.

Chapter 2 addresses this gap by examining the heterogeneous impact of corporate governance changes on firm innovation output, utilizing differences in national structures such as reform approach, compliance with the rule-of-law, corruption levels, and market development. Unlike previous studies that focused on the effect of corporate governance reforms while holding national structures constant, this study approach emphasizes the moderating role of country-level features. The overarching objective is to provide a comprehensive understanding of the role played by national structures in stimulating long-term growth. Theoretical underpinnings from Stein (1988, 1989) suggest that managerial behaviour influences firm innovation, with agency problems inducing managerial myopia. While a stronger corporate board may enhance monitoring and mitigate myopia, it could also exacerbate short-termism, posing a challenge to innovation. Importantly, the role of national structures in this dynamic remains unclear, considering varying reform approaches, external governance, corruption levels, and the developmental stage of economies. The Chapter 2 study contributes to the existing literature by reconciling conflicting findings on the impact of board reforms on innovation output, exploring the moderating effect of national structures, and offering comprehensive evidence on the long-term effects of board reforms on firm innovation. The broader implication is that a one-size-fits-all approach to corporate governance reform may be inadequate; instead, reforms must be tailored to the specific institutional context of each country.

Chapter 3 investigates CEOs with early-life disaster experience and how it impacts debt structure. Drawing on the upper echelons hypothesis proposed by Hambrick and Mason (1984), which posits that previous experiences shape senior executives' cognition and values, subsequently influencing firm behaviours, our study delves into the specific realm of CEOs' early-life disaster experiences and their consequential effects on firms' debt structure decisions.

Recognizing the long-term effects of early traumatic situations on individuals, particularly those arising from natural disasters, and the subsequent alterations in preferences and behaviours, we explore the potential impact of CEOs' trauma on their firms' debt structures. Leveraging a comprehensive sample of CEOs born in the United States and merging their biographical data with a database of natural disaster events, we distinguish between CEOs who experienced disasters during their formative years (ages 5 to 15) and those who did not. Our results suggest that CEOs with early-life disaster experiences exhibit a preference for issuing public debt over bank debt, aligning with the bank monitor theory. Our contributions to the literature include providing novel evidence on the link between CEO early disaster experiences and debt structure decisions, introducing an individual-level driver to complement existing firm and country determinants of debt structure, and contributing to the emerging body of research on CEOs' early-life exposure to disasters and its impact on corporate policies. Overall, this study enhances our understanding of the multifaceted factors influencing debt structure and emphasizes the substantial influence that CEOs' background experiences wield over strategic decision-making. This study suggesting that early-life experiences may shape CEOs' broader risk preferences and decision-making styles, which in turn can influence a wide range of corporate policies.

Chapter 4 investigates the impact of early-life disaster experiences on CEOs and how these CEOs' behaviour on corporate misconduct. Various forms of corporate wrongdoing, including accounting impropriety, insider trading, financial reporting revisions, and options backdating, Chapter 4 delves into the empirical question of how CEOs with early-life disaster experiences impact corporate misconduct by firm violations. Despite employing a comprehensive fixed effects model, the baseline findings reveal no significant correlation between CEOs with early-life disaster experiences and corporate misconduct. Addressing potential endogeneity, this study employs propensity score matching and entropy balancing, revealing consistent results.

Additional analyses, including a binary variable for corporate misconduct and subsample testing, further support the robustness of the findings. By exploring CEO traits and childhood disaster experiences, the study provides nuanced insights, demonstrating that even CEOs with childhood disaster experiences do not impact corporate misconduct. This research contributes to the understanding of CEO behaviour, particularly their influence on corporate misconduct, expanding the literature beyond the prevalent focus on board influences.

For further future research, this thesis strongly advocates a sustained and in-depth exploration of corporate governance dynamics, both at the board level through ongoing assessments of board reforms, and at the individual level by delving deeper into the intricate realm of CEO early-life experiences. Given the evolving landscape of global business environments and the nuanced interplay of governance structures, continuous scrutiny of board reforms becomes imperative. Research in this area should delve into the long-term implications of board reforms, examining not only their immediate effects on firm innovation, as explored in this study, but also their sustained impact on diverse facets of corporate behavior and performance. Simultaneously, extending investigations into the realm of CEO early-life experiences promises to enrich our comprehension of the multifaceted ways in which individual leaders shape organizational conduct. Future research could further scrutinize the psychological mechanisms and behavioural patterns that link early-life traumas, such as natural disasters, to decision-making processes at the executive level. Exploring additional dimensions of CEO early-life experiences, such as the influence on risk-taking propensity, ethical decision-making, and strategic choices, could offer a more holistic understanding of how personal histories permeate corporate leadership.

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