Three essays on corporate finance studies in China

A thesis presented in fulfilment of the requirements for the degree of

Doctor of Philosophy in Finance

at Massey University

Palmerston North, New Zealand

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2023

Abstract

This thesis investigates three aspects of listed firms in the Chinese market. The first essay in the thesis examines the impact of state ownership on firm performance using hand collected ownership data of firms with state-private mixed ownership structures. We find a U-shaped relationship between state ownership and firm performance. At lower levels, state ownership has a negative association with firm performance, but beyond a certain threshold (e.g., 55% for ROA and 44% for Tobin's Q), state ownership becomes positively associated with firm performance. This finding indicates a trade-off between the negative effects of grabbing hand and the monitoring benefits of state owners. In addition, the introduction of strategic investors moderates the influence of state ownership on firm performance. The results show that the U-shaped impact of state ownership on firm performance diminishes after the introduction of strategic investors, implying that strategic investors may mitigate the underperformance observed around the threshold state ownership levels. The second essay focuses on the corporate information environment. It investigates the behaviour of firms with politically connected executives regarding information disclosure when subject to government inspection influences. China initiated the central environmental protection inspection in 2016. We find that while firms with politically connected executives generally exhibit lower stock price crash risk, these politically connected firms are more prone to crash risk when subject to inspection influences than firms without political connections. Further, we examine whether the inspection effect on crash risk varies based on the type of political connections developed by executives, namely achieved and ascribed political connections. Our results show that firms with executives having achieved political connections are related to higher crash risk when under government inspection influences, but no significant impact is observed for firms with executives having ascribed political connections. The final essay examines the influence of firms' exposure to economic policy uncertainty (EPU) on environmental investment and investigates whether firm size plays a significant role in this relationship. We find that although small firms are generally associated with lower levels of environmental investment compared to large firms, there is a positive association between small firms' EPU exposure and environmental investment, indicating that small firms are more inclined to invest in environmental initiatives when facing higher EPU exposure.

Acknowledgements

I would like to express my sincere gratitude to all the people who have contributed to the completion of this thesis. I am also thankful for everyone I have encountered during my academic journey in New Zealand.

First, I would like to thank my supervisors, Professor Hamish Anderson and Associate Professor Jing Liao, for their invaluable guidance, unwavering encouragement, and continuous support throughout the time I have been working on the thesis. Their expertise, patience, and dedication have played a significant role in shaping this thesis. I am particularly thankful for their insightful feedback, meticulous attention to detail, and assistance in rectifying even the minutest formatting and writing errors. Working as a team with my supervisors has been an absolute pleasure, as they have always made me feel valued and welcomed.

I am grateful to Associate Professor Jing Liao, Dr Mui Kuen Yuen, and Dr Oscar Lau for always trusting me and guiding me in enhancing my teaching skills. Their belief in me and the opportunities they have provided have been instrumental in my growth as an educator. Their mentorship has shaped my teaching approach, and I truly appreciate their contributions to my professional development.

I would also like to thank everyone in the School of Economics and Finance at Massey University who has generously assisted me throughout my research journey and the completion of this thesis, whether directly or indirectly. I am thankful to all my PhD colleagues for their companionship. Thank you for sharing the laughter and life advice with me. I have to say that our hotpot is the best in Palmy! I am also thankful for our memorable trips to the North Island and Paihia, exploring new places and creating lasting memories. Additionally, the fitness classes we attended together kept us physically active and fostered a sense of community and well-being. My thanks also go to my seniors, Bilal, Sulu, and Peter, for their research insights when I was a first-year PhD student.

Finally, I am deeply grateful to my parents for their unconditional love and unlimited support. I am forever indebted to them for their belief in me and constant support throughout this journey. Without their love, none of this would have been possible.

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Chapter One

Introduction

1. Introduction

Corporate finance theories are largely developed and analysed from a Western market perspective. However, due to the significant organisational and behavioural differences between firms in emerging markets and those in developed markets (Fan et al., 2011), whether such theories and empirical findings are transferrable into non-western, emerging market settings is a moot point. Fan et al. (2011) argue that different institutional factors fundamentally influence firms and managerial behaviours in emerging markets. Therefore, country-level studies focusing on institutional variations in firm financing and governance choices may provide more insights to the growing finance literature.

Being the second-largest economy and the largest transition economy in the world (Allen et al., 2005; Luo et al., 2005; Prasad & Rajan, 2006), China's unique characteristics, as well as the substantial market changes and reforms provide a rich setting concerning this. Fan et al. (2011) emphasise the significance of research in emerging markets concerning factors such as firms' ownership structures, networks, and other formal and informal institutional forces. Therefore, this thesis delves into three distinct aspects that broadly fall into the stream of research by examining the effects of firm characteristics on corporate performance and investment outcomes specific to the Chinese setting. These include the effect of state-owned equity holdings on firm performance, the effect of managerial political ties on the firm's information environment in the presence of external environmental inspection shocks, and the influence of economic policy uncertainty on corporate investment decisions conditioned on firm size. As such, this thesis aims to offer insights that benefit policymakers, investors, and contribute to a broader understanding of corporate finance theories.

The first aspect is ownership structure, which is recognised as an important research interest in the field of corporate finance. It is observed that various forms of ownership structure have a wide impact on firms, such as firm value and performance, debt policy and financing decisions, corporate reputation, acquisition decisions, and executive compensation (Boubakri & Ghouma, 2010; Burns et al., 2010; Cao et al., 2011; Caprio et al., 2011; Delgado-García et al., 2010; Mataigne et al., 2021; Michel et al., 2014; Moh'd et al., 1998). The state remains one of the most important shareholders in both developing and developed countries (Ben-Nasr & Cosset, 2014). In China, the government plays an important role in business activities through its ownership in firms, leading to a pronounced presence of state ownership (Ding et al., 2021; Dong et al., 2021). However, the impact of state ownership on firm performance is still mixed due to the complexity of this ownership structure. While existing literature reveals that state ownership is associated with agency problems, and consequently performance and efficiency issues (e.g., Gan et al., 2018; Li et al., 2009b; Majumdar, 1998; Qi et al., 2000; Wei et al., 2005; Xu & Wang, 1999; Zhang et al., 2001), researchers also argue that firms benefit from state ownership due to government preferential treatments (Beuselinck et al., 2017; Faccio, 2006; Khwaja & Mian, 2005; Li et al., 2009a). Therefore, the first essay of the thesis examines how state ownership affects firm performance in firms with state-private mixed ownership structures.

The second essay of this thesis explores the impact of executives' political connections on listed firms. Many emerging markets, such as Asian countries, are relationship-based economies where economic activities rely on personal relations or social networks (Li et al., 2020d; Martinsons, 2008; Rashid, 2015). Consequently, relationship-based strategies, such as establishing and nurturing relationships with government authorities, become critical for firms in emerging markets (Cai et al., 2010; Chen et al., 2017; Zhou & Xu, 2012). Although the literature reveals that political connection significantly affects firm behaviours and decisions

(Boubakri et al., 2008; Chaney et al., 2011; Claessens et al., 2008; Faccio, 2006; Wong & Hooy, 2018), to our knowledge, there remains a lack of research on how managerial political ties affect corporate information environment under external shocks. Hence, essay two investigates the impact of executives' political connection on stock price crash risk in the presence of campaign-style inspections, utilising the increased scrutiny from governments' environmental protection inspections.

The last essay in this thesis studies the influence of economic policy uncertainty (EPU) on corporate investment decisions. Policy changes, such as fiscal, monetary, and regulatory policies, directly affect the macroeconomic environment in which firms operate (He et al., 2020; Lou et al., 2022; Luo & Zhang, 2020). Therefore, uncertainties in government policies and regulatory frameworks lead to a more volatile operating environment for firms. Existing studies demonstrate that corporate decision-making depends on firms' sensitivity to policy uncertainties because of different firm characteristics (Liu et al., 2017; Ma & Hao, 2022; Wang et al., 2014; Yang et al., 2019). Ball et al. (2021) indicate that firm size is one of the factors that affect firm-level sensitivity to macroeconomic shocks. This leads to the question of whether firm size matters to the impact of EPU on investment decisions. Therefore, essay three investigates the differential relationship between EPU exposure and environmental investment of large/small firms.

The next three sections of this chapter provide an overview of each of the three essays and highlight how each essay contributes to the existing body of knowledge. Section five outlines the research output during doctoral studies, and the last section presents the structure of the remainder of the thesis.

2. Essay One

The first essay in the thesis explores the impact of state ownership on firm performance in firms with state-private mixed ownership structures. The continuous reforms in state-owned

enterprises (SOEs) over the past decades highlight the important role that state ownership plays in the Chinese market.[1] For instance, in 2013, the 18th Communist Party of China (CPC) Central Committee highlighted the importance of a mixed economy with cross-shareholding by state-owned capital and non-public capital. According to a recent report by Yu (2023) in Financial Times, Chinese officials also call for creating a valuation system with Chinese characteristics, emphasising the value of state ownership according to its socialist credentials. The existing literature predominantly examines the relationship between state ownership and firm performance within the context of China's split-share structure (Gunasekarage et al., 2007; Sun et al., 2003; Tian & Estrin, 2008; Wei & Varela, 2003; Wei et al., 2005). The split-share structure refers to the presence of tradable and non-tradable shares, creating a dual-share system and causing significant interest conflicts between state and other shareholders (Tan et al., 2020). To our knowledge, there is little evidence regarding the impact of state ownership on firm performance after the concerns associated with the split-share structure have been solved.

Using a sample of Chinese listed firms with state-private mixed ownership structures from 2010 to 2019, we find that state ownership negatively affects firm performance at lower shareholding levels. However, as state ownership increases, we find a shift towards a positive relationship. For example, the negative impact of state ownership on firm performance changes to positive at higher levels of state ownership, such as 55% for ROA and 44% for Tobin's Q. This finding indicates a U-shaped association between state ownership and firm performance, suggesting a trade-off between the negative effects of grabbing hand and the monitoring benefits of state owners. More importantly, the U-shaped impact of state ownership on firm performance diminishes after the introduction of strategic investors, implying that strategic

[1] Early SOEs reforms are discussed in Liao et al. (2014), Liu and Gao (1999), Song et al. (2011), and Sun and Tong (2003).

investors may mitigate the underperformance observed around the threshold state ownership levels.

Our study contributes to the literature in two ways. First, we provide direct empirical evidence on the impact of state ownership on firm performance within the mixed state-private ownership structure. In contrast to recent studies that focus on the mixed-ownership structure reform as a shock (Ke & Wang, 2021; Li et al., 2020a; Li et al., 2020b; Wehrheim et al., 2020; Zhang et al., 2020), we specifically investigate the role of state owners within the mixed-ownership structure to explore the fundamental question of how this structure affects firm performance. Our finding provides insights to better understand the dynamic influence of state ownership and its impact on firm performance in mixed-ownership environments. Second, while previous studies examine the association between state ownership and firm performance during the split-share structure period (Gunasekarage et al., 2007; Sun et al., 2003; Tian & Estrin, 2008; Wei & Varela, 2003; Wei et al., 2005), there is limited evidence regarding this relationship after the split-share structure reform. We fill the gap by examining how state ownership influences firm performance once the concerns related to the split-share structure have been addressed. We provide implications to policymakers and practitioners that introducing strategic investors may mitigate underperformance around the threshold levels of state ownership, highlighting the role of strategic investors in addressing the challenges associated with state ownership and promoting the effectiveness of the mixed-ownership structure.

3. Essay Two

Essay two examines whether firms with politically connected executives behave differently compared with those without such connections regarding information disclosure when under the government inspection influence. As discussed, political influences in relationship-based economies, such as China, significantly affect firms. However, the impact

of political connections on corporate information environment still needs to be well examined, particularly in the context of campaign-style enforcement. In 2016, China initiated the central environmental protection inspection, making a significant milestone in its efforts to enhance environmental protection. This exogenous initiative captures the first instance that the central authority of China implemented standardised inspection measures for environmental governance (Li et al., 2020c; Liu et al., 2022; Wang et al., 2021), which provides an ideal setting for this study. We find that firms with politically connected executives are generally associated with lower crash risk. However, when these politically connected firms are subject to inspection influences, they exhibit higher stock price crash risk than firms without such political connections. We argue that politically connected managers are more likely to withhold negative information when facing campaign-style enforcement because releasing negative information increases reputational and political costs. In addition, we investigate the variation in the inspection effect on crash risk based on how executives develop their political connections, such as achieved and ascribed political connections. Achieved political connections are developed through executives' appointments to the National People's Congress or the Chinese People's Political Consultative Conference, whereas ascribed political connections are developed through executives' working experience as government officials. We find that firms with executives having achieved political connections are more likely to have higher crash risk under inspection influences.

Political connection is an important, yet understudied topic regarding the effectiveness of regulatory implementation (Tian et al., 2019). This study first contributes to the current body of knowledge concerning the influence of managerial political connections on corporate information environment. Although political connections serve as a resource for obtaining preferential treatment from the government (Faccio, 2006; Fan et al., 2007; Khwaja & Mian, 2005), we show that firms with political connections are associated with lower information

transparency in the presence of increased scrutiny. Therefore, our study provides insights to practitioners regarding the risk profile of political connections. That is, politically connected firms may face more challenges in managing negative information when there are external shocks. Secondly, while Zhang et al. (2021) find that government inspections improve corporate information transparency, our finding suggests that executives' political connections inhibit the efficiency of government regulatory policies. As such, this study provides implications for policymakers to implement regulatory policies in a more efficient way that addresses the influences associated with firm-level political connections.

4. Essay Three

The massive policy changes and reforms in China are associated with high uncertainty around economic policies, which draws growing attention concerning the impact of EPU on firm decision-making. While a wide range of studies finds a significant influence of the macro-EPU on firm behaviours (e.g., Dang et al., 2019; Gulen & Ion, 2015; He et al., 2020; Kong et al., 2022; Lou et al., 2022; Ma & Hao, 2022; Tabash et al., 2022; Tran, 2021; Wang et al., 2014; Xie et al., 2019), little attention is given to firms' heterogeneous exposure to EPU. Firms have varying sensitivities to EPU due to firm-specific characteristics, which influence their decision-making in response to uncertainties (Liu et al., 2017; Ma & Hao, 2022; Wang et al., 2014; Yang et al., 2019). Motivated by Ball et al. (2021) that firm size is one factor affecting firms' sensitivity to macroeconomic shocks, we examine the relationship between EPU exposure, environmental investment, and firm size in the last essay. We find that although small firms have a lower level of environmental investment compared to large firms, small firms are more likely to increase their environmental investment in response to higher EPU exposure. To understand why small firms increase environmental investment, our results show a positive relationship between environmental investment and small firms' acquisition of new bank loans, which suggests a potential benefit of environmental engagement.

Our study first contributes to the literature regarding the influence of EPU on investment decision-making, particularly in relation to corporate environmental engagement. Existing studies demonstrate the impact of macro-level policy uncertainties on various aspects of corporate behaviours, including information disclosure (Pan et al., 2020), environmental innovation (Kyaw, 2022; Yang et al., 2022), and green attitudes (Hou et al., 2022), the specific relationship between EPU and environmental investment remains understudied. Our study adds to this topic by focusing on firms' heterogeneous exposure to EPU, which provides new evidence to better understand the impact of policy uncertainties on corporate investment strategies. Secondly, our study contributes to the understanding that firm size matters in the context of EPU and environmental investment, highlighting the significance of considering firm-specific characteristics when examining the impact of policy uncertainties on firm decision-making. Small firms face more challenges in uncertain environments (Bajaj et al., 2021; Gertler & Gilchrist, 1994), therefore, small firms are advised to adopt proactive strategies to seize opportunities in times of uncertainty (Cao et al., 2020; Clemens et al., 2008; Tarkom & Ujah, 2023). Our study aligns with this argument and shows that increasing environmental investment can be a strategic action employed by small firms, offering benefits such as improved access to loans. As such, our study provides implications to policymakers regarding how policy uncertainties affect small firms, and insights to small firms regarding the potential strategic benefits of environmental engagement when facing higher exposure to uncertainties.

5. Research output during doctoral studies

Essay two:

- Yue, S., Anderson, H. D., & Liao, J. Political connection and stock price crash risk: evidence from the environmental protection inspection. Paper presented at the *27th Annual New Zealand Finance Colloquium*, Wellington, New Zealand, 2023

Other outputs:

- Boubaker, S., Cheng, F., Liao, J., & Yue, S. (2023). Environmental tax incentives and corporate environmental behaviour: An unintended consequence from a natural experiment in China. *European Financial Management*, 1-39.
- Anderson, H. D., Liao, J., & Yue, S. (2022). Financial expert CEOs, political intervention, and corporate investment decisions: evidence from the anti-corruption campaign. *International Journal of Managerial Finance*, *18*(3), 562-593.

6. Structure of the Thesis

The remainder of this thesis is structured as follows. Chapter Two presents the first essay, which investigates the impact of state ownership on firm performance. The second essay regarding the relationship between executives' political connection and stock price crash risk is discussed in Chapter Three. Chapter Four contains the last essay concerning the association between firm size and the impact of EPU exposure on environmental investment. A summary of the major findings and implications from each of the three essays is presented in Chapter Five. The final section lists all references for each chapter in this thesis.

Chapter Two

Essay One

The first essay regarding the impact of state ownership on firm performance is presented in Chapter Two. Introduction presents the overview of the first essay. Literature review and hypothesis development are then discussed. Sample and variable construction section explains the main variables used in this study in detail. Empirical analysis section illustrates the research methodology and discusses how state ownership affects firm performance. The reference for the first essay is listed in the final section of this thesis.

The impact of state ownership on firm performance: A trade-off between the grabbing hand effect and monitoring effect

Abstract

Using hand collected data of state ownership in Chinese listed firms, we find a U-shaped relationship between state ownership and firm performance. The empirical evidence shows that state ownership is negatively (positively) related to firm performance when it is up to (beyond) a threshold level (e.g., 55% for ROA and 44% for Tobin's Q), indicating a trade-off between the negative effects of grabbing hand when state ownership is minor and the monitoring benefits of state owners when they hold a large stake of shares. Further, we find that the introduction of strategic investors moderates the influence of state owners on firm performance. That is, the U-shaped impact of state ownership on firm performance is more salient before the introduction of strategic investors.

1. Introduction

The Chinese government launched a new round of mixed-ownership reform in state-owned enterprises (SOEs) by allowing more private capital to be invested in SOEs in 2013.[2] The mixed-ownership reform aims to diversify the ownership structure in SOEs, mitigate the dominant interest of state shareholders, improve corporate governance, and enhance SOE performance and efficiency (Guan et al., 2021; Yang & Xie, 2022). There is a renewed interest in investigating the impact of state ownership on firm behaviour due to the implementation of the mixed-ownership reform. Although it has been found that state ownership in general has both positive (Beuselinck et al., 2017; Ma et al., 2016) [3] and negative impacts on firms (Bai et al., 2006; Boycko et al., 1996; Dewenter & Malatesta, 2001; Mar & Young, 2001; Megginson & Netter, 2001), there is still a lack of evidence regarding the influence of state owners in the mixed-ownership structure. Therefore, we examine the impact of state ownership on firm performance under China's mixed-ownership structure setting.

The impact of state ownership on firm performance remains an open question because of two competing views. On the one hand, governments may have a grabbing hand because they may consume corporate resources for political objectives (Shleifer & Vishny, 1994, 2002). For instance, the government may use firms' resources to pursue social and non-economic objectives, such as over-employment and over-investment (Li et al., 2020c; Nguyen & Vo, 2020). Therefore, state ownership may bring firms heavy policy burdens and distorted operational objectives (Li et al., 2020c; Zhang et al., 2021). Li et al. (2020b) illustrate that the government may pressure private acquirers to take on more political liabilities after their acquisition of state equity. Due to the natural connection between state ownership and the

[2] In 2013, the Third Plenary Session of the 18th Communist Party of China (CPC) Central Committee adopted the decision of deepening mixed-ownership reform.

[3] For instance, researchers find that state ownership alleviates corporate financial constraints and enhances corporations' access to finance and government subsidies, which benefit firms (Faccio, 2006; Khwaja & Mian, 2005; Li et al., 2009a; Zhang & Liu, 2020).

government, the increased state ownership may induce governments' grabbing hand incentives and deviate firms' objectives from wealth maximisation. On the other hand, state owners may also play a monitoring role (Bos, 1991). Increased cash flow rights will cost shareholders more when they distort the objective of wealth maximisation, therefore, shareholders' wealth is more closely tied to firm performance as their shareholding stake increases (Ding et al., 2007). As such, large shareholders tend to have better-aligned interests with firms (Ding et al., 2007) and stronger incentives and power to monitor management at a lower cost (Grossman & Hart, 1986; Lins, 2003; Shleifer & Vishny, 1986). Considering the cost and benefit trade-off of monitoring, increased ownership may motivate state owners to monitor firm management (Tian & Estrin, 2008), which results in better firm performance.

To examine how competing influences of state ownership affect firm performance, we hand collect state ownership data for 1,976 Chinese listed firms with a state-private mixed ownership structure from 2010 to 2019. Our results indicate that state ownership has a U-shaped impact on firm performance, suggesting firm performance is affected by the trade-off between the negative effects of grabbing hand and the monitoring benefits of state owners. In our study, state owners exhibit a negative impact on firm performance when their ownership is less than a threshold level (e.g., 55% for ROA and 44% for Tobin's Q). Governments, as minority shareholders, may have the incentive to tunnel corporate resources for political objectives. Even though their ownership is small, they may still be able to do so due to their strong political power. Our results indicate that state owners' incentives of grabbing hand appear to be more likely than the incentives of monitoring when their ownership is less than the threshold level. However, the incentives of monitoring outweigh the incentives of grabbing hand when state ownership exceeds the threshold level, resulting in a positive impact of state ownership on firm performance. Our additional analysis further indicates that increased state ownership is associated with more managerial opportunism and worse corporate governance

when it is lower than the threshold, where the grabbing hand of government is more likely. On the other hand, increased state ownership is associated with less managerial opportunism and better corporate governance when it exceeds the threshold, which supports the monitoring view.

Our study further examines whether and how the introduction of strategic investors affects the influence of state owners on firm performance. We find that the introduction of strategic investors moderates the influence of state shareholders on firms. Strategic investors refer to long-term investors who can provide not only additional capital to firms through their investment but also managerial expertise through the appointment of board directors (Espenlaub et al., 2016; Sun et al., 2013). Introducing strategic investors is an important strategy to improve corporate governance and performance in the mixed-ownership structure. Strategic investors provide benefits such as new technology, market access, and financial resources (Sun et al., 2013; Yang & Xie, 2022), as well as enhancing corporate governance and management efficiency through new director appointments (Wu et al., 2015; Yang & Xie, 2022). As strategic investors have stronger incentives to supervise the management and even controlling shareholders due to their bargaining power and profit-seeking nature (Yuan et al., 2021), they may moderate the grabbing hand effect of state ownership below the threshold state ownership levels. Constructing the subsample analysis of firms before and after the introduction of strategic investors, we find that the U-shaped impact of state ownership on firm performance diminishes after introducing strategic investors, implying that strategic investors may mitigate the underperformance observed around the threshold state ownership levels.

An important issue that challenges ownership structure studies is that state ownership is not exogenous. Existing studies have used various methods to address this endogeneity problem, including the instrumental variable (IV) approach (Ben-Nasr & Cosset, 2014; Boubakri et al., 2013; Boubakri et al., 2020; Chen et al., 2017; Tian & Estrin, 2008; Wei & Varela, 2003; Wei et al., 2009). Due to the nature of state ownership, it is challenging to

construct a proper IV that only affects state ownership but is not related to firm performance. It has been found that the difference between individualistic and collectivist cultures affects government interventions (Boubakri et al., 2015; Boubakri & Saffar, 2018). Therefore, firms in collectivist societies are more likely to have higher state ownership. As such, we use the unique data from the Chinese General Social Survey (CGSS) regarding the degree of individualistic and collectivist culture in different provinces as IV to examine the causality between state ownership and firm performance. The results based on the IV approach are consistent with our main findings.

Our study contributes to the literature in several aspects. First, we provide direct empirical evidence regarding the impact of state ownership on firm performance in the mixed state-private ownership structure. The mixed-ownership structure may improve corporate governance and increase firm competitiveness (Guan et al., 2021). Although researchers provide evidence that the mixed-ownership reform has a significant impact on corporate behaviour,[4] a fundamental corporate finance research question has not been tackled, e.g., it is unclear whether a mixed-ownership structure can improve firm performance (Wang et al., 2021b; Zhang et al., 2020). Different from recent mixed-ownership literature that examines the impact of the reform as a shock (Ke & Wang, 2021; Li et al., 2020a; Li et al., 2020b; Wehrheim et al., 2020; Zhang et al., 2020) or investigates the reform intensity among different types of shareholders (Wang et al., 2021a; Wang et al., 2021b), we particularly focus on the role state owners play in the mixed-ownership structure. Additionally, our hand collected data allows us to construct the percentage of state ownership rather than a simple SOE dummy variable that is widely used in Chinese studies (e.g., Chen et al., 2011b; Guo et al., 2021; Hao & Lu, 2018; Ma et al., 2016; Zhang & Liu, 2020; Zhou, 2017). As such, we provide insights to understand

[4] Existing studies examine the impact of the mixed-ownership reform on corporate innovation (Zhang et al., 2020), tax avoidance (Wang et al., 2021b), and whether the reform shapes the influence of the board directors on firm performance (Guan et al., 2021).

the dynamic influence of state ownership and its impact on firm performance in mixed-ownership environments.

Second, previous share issue privatisation (SIP) studies (Gunasekarage et al., 2007; Sun et al., 2003; Tian & Estrin, 2008; Wei & Varela, 2003; Wei et al., 2009) examine the relationship between state ownership and firm performance during China's split share structure period which exacerbates the interest conflicts between state and other shareholders (Tan et al., 2020).[5] However, to our knowledge, there is little evidence regarding this relationship after China's important split-share structure[6] reform (NTS reform hereafter). The NTS reform mitigates the misalignment of interests between controlling and minority shareholders (Chen et al., 2015) and facilitates China's continued privatisation (Liao et al., 2014). We fill the gap by examining how state ownership in the mixed-ownership structure affects firm performance after the split-share structure concerns are resolved. We contribute to the literature from a government policy perspective. We show that in the post-NTS period, where interest misalignment between state and non-state shareholders has been reduced, state owners may still present competing incentives of grabbing hand and monitoring on firms. However, the introduction of strategic investors moderates the influence of state owners on firms, particularly the underperformance around the threshold state ownership levels. Our finding indicates that strategic investors may help solve the problem related to the actual owner absence of state ownership, which provides implications for policymakers regarding the role strategic investors play in the promotion of mixed-ownership structure.

The rest of the paper is organised as follows. Section 2 reviews the major reforms of corporate ownership structure in China and develops hypothesis. Section 3 describes the data,

[5] The price of non-tradable state shares is based on the book value of firm assets instead of the market value, but non-tradable shareholders have the same voting and cash flow rights as tradable shareholders.
[6] Split-share structure refers to the dual share structure of tradable and non-tradable shares.

sample, and variables used in this paper. Section 4 discusses the research methodology and empirical results. Section 5 concludes.

2. Literature review and hypothesis development

2.1. A brief introduction of the ownership structure reform

Over the past decades, research has extensively highlighted the importance of ownership structure on corporate performance and policy (e.g., Ang et al., 2000; Boubakri & Ghouma, 2010; Burns et al., 2010; Cao et al., 2011; Caprio et al., 2011; Kahn & Winton, 1998; Peng et al., 2004; Stoughton & Zechner, 1998; Wei & Zhang, 2008). Chinese firms were fully controlled by the government before the economic reform in 1978. Since then, a series of reforms have been made to improve poor productivity and efficiency in these SOEs (Huang & Wang, 2011). [7] According to Qi et al. (2000), SOE reform is the key to the success of the Chinese economy. To further alleviate the problem of performance deterioration in SOEs, China initiated the SIP in the early 1990s, in which SOEs were listed on stock markets by selling a proportion of shares to private investors (Gan et al., 2018; Jiang et al., 2009; Wang & Xiao, 2009).

The SIP led to the early emergence of the mixed-ownership structure in Chinese listed firms. Following the establishment of the Shanghai Stock Exchange and Shenzhen Stock Exchange in 1990 and 1991, five types of shares were listed on the market, including state shares, legal person shares, employee shares, tradeable A shares and B shares (Fan et al., 2014; Huang & Wang, 2011; Liao et al., 2014; Sun & Tong, 2003; Sun et al., 2003).[8] Almost all listed firms were SIP firms up to the end of 2000 as most were former 100% government-owned

[7] The early reforms in the 1980s include the administrative decentralisation and profit retention, the policy of ligaihshui and bogaidai, and the system of Contractual Management as discussed in Liao et al. (2014), Liu and Gao (1999), Song et al. (2011), and Sun and Tong (2003).

[8] State shares and legal person shares are non-tradable and are prohibited from trading publicly on the market. Employee shares are issued in a limited quantity and have a holding period of six to twelve months since issued. Not all firms issue employee shares. After the holding period, employee shares become tradable A shares once sold.

enterprises (Li et al., 2019; Sun & Tong, 2003). Although SIP only introduced a small proportion of private investors to SOEs and did not change the state control of those firms (Jiang et al., 2009; Sun & Tong, 2003; Tu et al., 2013; Xu & Wang, 1999), it still allowed private ownership to be merged with the government ownership. As one of the key steps in the economic development, the promotion of mixed ownership has always been a government agenda over the past decades.[9] Even in recent years, the government continues to strengthen and promote the mixed-ownership structure. For example, in 2013, the Third Plenary Session of the 18th CPC Central Committee adopted *The Decision of the CPC Central Committee on Major Issues Concerning Comprehensively Deeping Reform* (*the Decision*, hereafter), which points out the importance of a mixed economy with cross-shareholding by and mutual integration of state-owned capital, collective capital, and non-public capital. According to *the Decision*, SOEs are encouraged to develop into mixed-ownership firms. Starting in 2014, the SASAC gradually initiated a pilot program of the mixed-ownership reform in selected central SOEs, and the number of selected SOEs increased to 50 by 2016.[10] In 2020, SASAC initiated *A three-year action plan for China's SOEs reform* (*the Plan*) with the deepening of the mixed-ownership structure as one of its targets, designed to take the mixture of state ownership and non-state ownership into a new stage.

2.2. The impact of state ownership in the mixed-ownership structure

The presence of non-state shareholders in the mixed-ownership structure balances the power of controlling state shareholders and forms a supervision mechanism of internal control (Guan et al., 2021). Guan et al. (2021) argue that a heterogeneous group of shareholders can restrain and supervise the behaviour of major shareholders. Therefore, the presence of non-state shareholders helps to restrict dominant political objectives associated with state

[9] For example, the SOE reform and the discussion of mixed ownership are also mentioned in the reports of the 15th and 16th National Congress of the Communist Party of China in 1997 and 2002, respectively.
[10] In 2014, China National Building Materials Group Corporation and China National Pharmaceutical Group Corporation were selected as the first pilot to implement the mixed ownership reform.

ownership because private shareholders have stronger incentives to pursue wealth maximisation (Goldeng et al., 2008; Wang et al., 2021a). This can lead to an improved corporate governance structure (D'Souza et al., 2000; Dharwadkar et al., 2000; Hanousek et al., 2009), as well as improved internal governance (Guan et al., 2021). Allowing private capital to be merged with state capital may also enhance the market competition and response mechanism. As such, private firms can enjoy government support through state ownership and even enter monopoly industries that the government controls.[11]

According to Bos (1991), the government may serve as an internal regulator. Increased cash flow rights are associated with higher expenses for large shareholders when they engage in expropriation from the firm for their private benefit (Ding et al., 2007). Consequently, the wealth of large shareholders is closely tied to firms' successful performance, particularly as their shareholding stake increases. The increased ownership facilitates the alignment of interests between shareholders and firms (Ding et al., 2007) and also empowers shareholders to monitor and discipline management at a lower cost (Grossman & Hart, 1986; Lins, 2003; Nguyen et al., 2015; Shleifer & Vishny, 1986). According to Bai et al. (2004), large shareholders are less likely to engage in tunnelling if they can better align their interests with that of the firm. Qi et al. (2000) and Tian and Estrin (2008) argue that large shareholders have stronger incentives to monitor firm management considering the cost and benefit trade-off. As such, state owners may play an effective monitoring role with the continued ownership in the mixed-ownership structure.

However, state ownership can be associated with agency problems that lead to issues such as poor performance and low efficiency (e.g., Li et al., 2009b; Majumdar, 1998; Xu & Wang, 1999; Zhang et al., 2001), and low financial transparency (Bushman et al., 2004;

[11] REPORT ON THE WORK OF THE GOVERNMENT of the year 2017 shows that the Chinese government will deepen reform to establish mixed-ownership systems, and make substantive progress in industries including electric power, petroleum, natural gas, railways, civil aviation, telecommunications, and defence.

Guedhami et al., 2009). Shleifer and Vishny (1994) and Shleifer and Vishny (2002) argue that governments have a grabbing hand because they may consume firm resources for political benefits. In line with the grabbing hand effect, Chen et al. (2014), Hou et al. (2012), and Liao et al. (2014) document that state shareholders have weaker incentives to maximise firm value but stronger incentives to pursue political goals. For instance, SOEs may keep not-for-profit units or non-performing assets for political objectives (Lin et al., 2014; Wei & Xiao, 2009). Governments have been found to affect corporate decisions for political objectives (Ben-Nasr & Cosset, 2014; D'Souza & Nash, 2017; Dinc & Gupta, 2011; Jones, 1999; Piotroski & Zhang, 2014). For example, governments can make appointments of managers for political reasons rather than managers' managerial ability (Fan et al., 2007; Mar & Young, 2001). In China, governments can appoint, select, or dismiss top executives in SOEs (Cao et al., 2017; Chen et al., 2011a; Fan et al., 2007; Hao & Lu, 2018; Kato & Long, 2006). Consequently, politically appointed managers are more likely to pursue political goals (Arocena & Oliveros, 2012; Nguyen & van Dijk, 2012; Sheshinski, 2003). As such, governments' political goals, such as promoting social stability, employment, and regional development, may deviate firm objectives from wealth maximisation (Bai et al., 2006; Boycko et al., 1996; Dewenter & Malatesta, 2001; Fan et al., 2007; Mar & Young, 2001; Megginson & Netter, 2001).

Accordingly, we argue that the impact of state ownership on firm performance is driven by the trade-off between the grabbing hand and monitoring incentives of state owners under the mixed-ownership structure. Since monitoring firm management is costly (Tian & Estrin, 2008), state owners with relatively small ownership tend to have fewer incentives to monitor firm management but more incentives to obtain private benefits or pursue political objectives. Consequently, the grabbing hand incentives outweigh the incentives of monitoring when state shareholders do not have significant control of firms, leading to a negative impact on firm performance. On the other hand, once state ownership becomes sufficiently large, state

shareholders tend to be motivated by their continued ownership to actively monitor firm management. Therefore, the monitoring effect outweighs the grabbing hand effect, resulting in a positive impact on firm performance. As such, we test the following hypothesis:

H1. State ownership has a U-shaped impact on firm performance.

2.3. The impact of state ownership with the introduction of strategic investors

The introduction of strategic investors is commonly used by firms to improve their management and performance (Brockman et al., 2016). In general, strategic investors tend to actively manage firms by setting strategic goals through long-term participation on the board (Brockman et al., 2016). Therefore, introducing strategic investors helps to improve corporate governance and performance (Sun et al., 2013). For instance, using the Hong Kong IPO market data, Brockman et al. (2016) and Espenlaub et al. (2016) demonstrate that strategic investors have a stronger commitment to firms' post-IPO survival and positively impact firms' long-term operating performance. Yang and Xie (2022) find that strategic investors increase the sensitivity of investment to growth opportunities in Chinese SOEs, indicating a positive effect of strategic investors on corporate capital allocation. Focusing on the banking sector in China, studies also show that strategic investors help to increase bank efficiency (Sun et al., 2013).

Due to the absence of actual owners associated with state ownership, state owners tend to have weak incentives to monitor firm management, especially when their shareholding stake is small (Yang & Xie, 2022). However, strategic investors have strong incentives to participate in corporate decisions and governance due to their long investment horizons and close business relationship with firms (Yang & Xie, 2022). In addition, critical resources, technologies, and market networks give strategic investors stronger negotiating power and more seats on the board. Since the power derived from strategic resources enables strategic investors to significantly affect corporate governance, it is possible that strategic investors can moderate state owners' influence on firm performance. Therefore, we propose the following hypothesis:

H2. The U-shaped impact of state ownership on firm performance becomes less salient after the introduction of strategic investors.

3. Sample and variable construction

3.1. Data and sample

The initial sample of this study includes all the companies listed on the Shanghai and Shenzhen Stock Exchanges from 2010 to 2019. The implementation of the NTS reform has brought a notable change in the tradability of state shares, transforming them from non-tradable shares to A shares. However, this transformation leads to a challenge when identifying state ownership in firms using the shareholder information from the China Stock Market and Accounting Research (CSMAR) database. As such, we hand collect the ownership data of the top 10 largest shareholders for all listed firms because top 10 shareholders are firms' major shareholders. On average, the percentage of total shareholding covered by the top 10 largest shareholders in our sample is 57%. Specifically, we manually collect the number of shares held by the top 10 largest shareholders and the identity of shareholders from *Sina Finance* (https://finance.sina.com.cn), which categorises shareholders into state shares, non-state domestic shares, and foreign shares. For firms that do not have shareholders' identities released on *Sina Finance*, we manually collect such information from firms' annual reports. Since our data are obtained from two sources, we cross-check the final data in our sample to ensure the accuracy and consistency of the data.

Financial data is obtained from the CSMAR database. Macroeconomic data such as Gross Domestic Product (GDP) is obtained from the National Bureau of Statistics of China (NBSC). After removing firms with no state-owned shares, financial firms, firms that have been delisted, and those with missing information, the final sample includes 1,976 listed firms with the state-private mixed ownership structure from 2010 to 2019, corresponding to 12,378 firm-year observations from 18 industries classified by China Securities Regulatory

Commission (CSRC). We winsorise the data at the 1% and 99% levels to minimise the effect of outliers.

3.2. Variable construction and descriptive statistics

3.2.1. Firm performance

Following studies such as Gan et al. (2018) and Kubo and Phan (2019), we construct two variables as the proxy of firm performance. $ROA_{i,t}$ is the accounting measure of firm performance and calculated as net income over total assets. In addition, we use $Tobin's\ Q_{i,t}$ to measure a firm's market performance, which is market value of equity, minus book value of equity, plus book value of assets, and then divided by book value of total assets (Chen et al., 2017).

3.2.2. State ownership

A number of studies on state ownership have been carried out using a dummy variable that equals one if the firm is ultimately controlled by the state (an SOE dummy) to proxy the effect of state ownership (e.g., Chen et al., 2011b; Guo et al., 2021; Hao & Lu, 2018; Ma et al., 2016; Zhang & Liu, 2020; Zhou, 2017). However, using the SOE dummy fails to measure the magnitude of state shareholding. Using the hand collected data, we construct a continuous variable $State\ Shares_{i,t}$ that is the total percentage of shares held by the state in a firm. Panel A of Table 1 reports the time trend of state ownership. On average, the proportion of state shareholding in Chinese listed firms decreases from 33.5% in 2010 to 25.62% in 2019. This trend is in line with the promotion of mixed-ownership structure in China. The increase of mixed state-private ownership is also illustrated in Figure 1. Panel B of Table 1 reports the distribution of state ownership by industry. On average, regulated industries, such as culture,

sports and entertainment, as well as electric power, heat, gas and water production and supply, are associated with higher state ownership than other industries.[12]

[Insert Table 1 here]

[Insert Figure 1 here]

3.2.3. Control variables

Following the existing literature, we control for the variables influencing firm performance and report the descriptive statistics in Table 2. According to studies such as Chen et al. (2017), Huang and Zhu (2015), Sun and Tong (2003), Wei et al. (2009), Xu and Wang (1999), and Zhang et al. (2001), foreign investors tend to actively monitor firm management and affect firm performance. Therefore, we construct $Foreign\ Shares_{i,t}$, which is the proportion of shares held by foreign investors. The average proportion of foreign shares among the top 10 shareholders over the sample period is around 3%. $Firm\ Size_{i,t}$ refers to the natural logarithm of total assets. $Firm\ Age_{i,t}$ is calculated as the natural logarithm of one plus the number of years the firm has been listed. On average, sample firms in this study have been listed for around 9.5 years. $Leverage_{i,t}$ is the ratio of total debt over total assets.

In addition, we control for the impact of corporate governance variables, which include CEO characteristics such as age, gender, and tenure.[13] $CEO\ Age_{i,t}$ refers to the natural logarithm of a CEO's age in year t. $CEO\ Gender_{i,t}$ is a dummy variable equal to one if the CEO is a male, and zero otherwise. $CEO\ Tenure_{i,t}$ is calculated as the natural logarithm of one plus the number of months the CEO has been in the current position. The average CEO tenure over the sample period is around 2.7 years. Additionally, we control for CEO power proxied by $Duality_{i,t}$, which is a dummy variable equal to one if the CEO also serves as board

[12] To address the concern that our findings could by driven by highly regulated industries, we use a refined sample excluding highly regulated industries. As reported in Appendix A4, our results remain unchanged.
[13] Studies have highlighted the important role of CEO characteristics in corporations (e.g., Antia et al., 2010; Khan & Vieito, 2013; Serfling, 2014; Yim, 2013).

chairman and zero otherwise.[14] We also control for the impact of board composition[15] with $Female\ Director_{i,t}$ as the proxy for board gender diversity, which is the percentage of female directors on the board, $Board\ Size_{i,t}$ which is the natural logarithm of total number of directors on the board, and $Board\ Independence_{i,t}$ calculated as the percentage of independent directors on the board. The average proportion of female directors and independent directors in sample firms is around 13% and 37%, respectively. Last, we construct $Provincial\ GDP\ Growth_{i,t}$ to address the impact of general economic development over time, which is the Chinese annual provincial GDP growth rate. A detailed definition of all variables used in this study is reported in Appendix A1. We also report the correlation matrix for the main variables used in the regression analysis in Table 3, which indicates that multicollinearity is not a concern in this study.

[Insert Tables 2 and 3 here]

4. Empirical analysis

4.1. The impact of state ownership on firm performance

To study the impact of state ownership on firm performance in the mixed-ownership structure setting, we construct our baseline regression using panel data and $State\ Shares_{i,t}$ as our main variable of interest. The baseline regression model is constructed as follows:

$$\begin{aligned} Dep_{i,t} = {} & \alpha + \beta_1 State\ Shares_{i,t} + \beta_2 State\ Shares_{i,t}^2 + \beta_3 Foreign\ Shares_{i,t} \\ & + \beta_4 Firm\ Size_{i,t} + \beta_5 Firm\ Age_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 CEO\ Age_{i,t} \\ & + \beta_8 CEO\ Gender_{i,t} + \beta_9 CEO\ Tenure_{i,t} + \beta_{10} Duality_{i,t} \\ & + \beta_{11} Female\ Director_{i,t} + \beta_{12} Board\ Size_{i,t} + \beta_{13} Board\ Independence_{i,t} \\ & + \beta_{14} Provincial\ GDP\ Growth_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

[14] Hsu et al. (2021) and Yang and Zhao (2014) find that CEO duality significantly affects firm performance.
[15] Studies show that board characteristics, including gender diversity (Bennouri et al., 2018; Liu, 2018; Liu et al., 2014) and board independence (Liu et al., 2015) matter to corporate governance.

where $Dep_{i,t}$ is the performance measures for firm *i* in year *t*. $State\ Shares^2{}_{i,t}$ is the squared value of $State\ Shares_{i,t}$. We use $State\ Shares^2{}_{i,t}$ to examine the non-linear relationship between state ownership and firm performance following Tian and Estrin (2008), Sun et al. (2003), and Wei et al. (2009). We also control for firm- and year-fixed effects in Model (1).

Table 4 reports the results of Model (1). Column (1) refers to the regression using $ROA_{i,t}$ as the proxy for firm performance whereas Column (2) uses $Tobin's\ Q_{i,t}$ as the proxy for firm performance. In both columns, we find that $State\ Shares_{i,t}$ is negatively related to $ROA_{i,t}$ and $Tobin's\ Q_{i,t}$ but $State\ Shares^2{}_{i,t}$ is positively related to $ROA_{i,t}$ and $Tobin's\ Q_{i,t}$. All results are statistically significant at the 1% level. In addition, the coefficients between $State\ Shares_{i,t}$ and $State\ Shares^2{}_{i,t}$ are statistically different when using $ROA_{i,t}$ as the dependent variable, with F-value = 21.89 and p-value = 0. The coefficients between $State\ Shares_{i,t}$ and $State\ Shares^2{}_{i,t}$ are statistically different when using $Tobin's\ Q_{i,t}$ as the dependent variable, with F-value = 50.27 and p-value = 0. Therefore, state ownership has a U-shaped relation with firm performance. As illustrated in Columns (1) and (2), the results show that sample firms tend to have the lowest ROA when the proportion of state ownership is 55.34%, and firms tend to be associated with the lowest Tobin's Q when the proportion of state ownership is 43.77%.[16] We also report the full results illustrating how the findings evolve in detail in Appendix A5.

Large blockholding by the state is common in Chinese listed firms (Chen et al., 2006; Conyon & He, 2011; Gunasekarage et al., 2007). The literature shows that concentrated ownership affects firms in different aspects in terms of firm value, performance, and governance (Bhaumik & Selarka, 2012; Conyon & He, 2011; Slovin & Sushka, 1993). As discussed, increased state shareholding may enhance the monitoring effect of state and better

[16] the threshold level is calculated as the absolute value of the coefficient on *State Shares* over two multiplied by the coefficient on *State Shares*^{2}.

align state holders' interests with other investors. However, the expropriation view argues that shareholders with concentrated ownership could also easily expropriate minority shareholders and extract private benefits through their control (Claessens et al., 2002; La Porta et al., 1999; La Porta et al., 2002). Our findings support the first argument that ownership concentration improves the monitoring role of state shareholders.

To illustrate the findings, we graph the impact of different degrees of state ownership on firm performance in Figure 2 while controlling all the other variables constant at their means. The vertical axis represents firm performance, and the horizontal axis represents the percentage of state ownership. As shown in Figure 2, state ownership has a negative impact on firm performance when its shareholding is relatively small. For instance, ROA in Figure 2 (a) decreases as state shares increase before the threshold level of 55%. Consistent with *Hypothesis 1*, due to the monitoring cost, state owners may become free-riders and expropriate corporate resources for political objectives when their ownership is relatively small. Consequently, the grabbing hand effect becomes more pronounced and negatively impacts firms (Shleifer & Vishny, 1994, 2002). However, the negative impact turns to positive when state ownership becomes larger, e.g., ROA becomes positively associated with state ownership when state ownership is over 55%. Large shareholdings are associated with increased cash flow rights, which links large shareholders' wealth more closely to firms' performance (Ding et al., 2007; Tian & Estrin, 2008). As such, state shareholders with significant shareholding tend to have more aligned interests with other shareholders, and have stronger incentives to improve the firm's performance to protect their wealth (Bai et al., 2004; Qi et al., 2000; Tian & Estrin, 2008). Meanwhile, firms also tend to be more strictly monitored when governments become the dominant shareholder (Bos, 1991) and have better access to preferential treatment from the government (Wei et al., 2020; Zhang et al., 2015). Consequently, the monitoring effect becomes more pronounced and results in a positive impact on firms.

Additionally, we find foreign ownership is positively associated with firm performance, which is in line with the literature that foreign investors positively affect firm performance (Chen et al., 2017; Huang & Zhu, 2015). Larger firms are associated with higher ROA but lower Tobin's Q, as do older firms. We also find that CEO and the board characteristics have more influence on Tobin's Q than ROA. For example, older CEOs, larger board size, and higher board independent ratio positively influence Tobin's Q but do not significantly affect ROA.

Overall, results in Table 4 indicate that state shareholders have a dynamic impact on firm performance depending on their shareholdings. The U-shaped impact supports *Hypothesis 1* that there is a trade-off between the negative grabbing hand effects and the monitoring benefits of state owners.

[Insert Figure 2 and Table 4 here]

4.2. The impact of strategic investors

To examine if and how the introduction of strategic investors affects the impact of state ownership on firms, we hand collect whether firms introduce strategic investors based on information revealed in firms' annual reports. Specifically, we collect the year that a firm attracts strategic investors for the first time and construct a dummy variable *Strategic Investors*, which equals one for years after the introduction of strategic investors and zero otherwise. We then construct a subsample analysis and report the results in Table 5.

Columns (1) and (2) refer to the subsample of firms before the introduction of strategic investors. We find the coefficients of $State\ Shares_{i,t}$ are all negatively related to firm performance measures at the 1% level. Meanwhile, the coefficients of $State\ Shares^2{}_{i,t}$ are all positively and significantly related to firm performance, indicating state ownership has a U-shaped impact on firm performance before introducing strategic investors. However, after strategic investors join a firm, we find that the previously significant U-shaped relation between

state ownership and firm performance disappears as shown in Columns (3) and (4) for the subsample of firms after introducing strategic investors.

In addition, we include *Strategic Investors* as an additional control variable in Model (1) to examine the impact of strategic investors on firm performance. We report the results in Appendix A2, we find that the coefficient on *Strategic Investors* is positive and significant at the 1% level in Column (1), indicating firms are associated with increased ROA after the introduction of strategic investors. However, we do not find significant impact of strategic investors on Tobin's Q as in Column (2).

Overall, the results in Table 5 show that the U-shaped relation between state ownership and firm performance is more (less) salient before (after) the introduction of strategic investors, which supports *H2* that introducing strategic investors moderates the influence of state owners on firm performance.[17] The U-shaped impact of state ownership on firm performance indicates that firm underperformance is associated with the mixed-ownership structure, particularly around the threshold state ownership levels. Our finding that the introduction of strategic investors could moderate firm underperformance is in line with the existing literature that strategic investors have stronger incentives to engage in corporate decisions and governance due to their long-term investment horizons, which improves firm performance (Brockman et al., 2016; Sun et al., 2013; Yang & Xie, 2022).

[Insert Table 5 here]

4.3. Alternative measures of state ownership

4.3.1. Single largest state owners

Current literature has broadly examined the impact of state ownership on firms using the total fraction of shares owned by the state (e.g., Ben-Nasr & Cosset, 2014; Li et al., 2009b;

[17] As a robustness check, we remove firms that never introduce strategic investors over the sample period and repeat the same subsample analysis. We find the same result that state ownership has a U-shaped impact on firm performance before the introduction of strategic investors. The results are not tabulated and available on request.

Megginson et al., 2014; Qi et al., 2000; Wei et al., 2009; Xu & Wang, 1999). However, state ownership can be concentrated in a single state owner or dispersed among several state owners. For example, Grinm Semiconductor Materials Co., Ltd. (GRITEK) and Unisplendour Guhan Group Co., Ltd. (UGC) are two firms from the manufacturing industry that had near identical aggregated state ownerships of 39.68% and 39.73% respectively in 2010. The state ownership was concentrated in a single state owner in GRITEK[18] but was dispersed among four different state owners in UGC[19]. One concern is that although a firm has a high level of state ownership, it can be shared among multiple state shareholders with different political objectives. As a result, individual state shareholders may have weaker incentives to monitor firm management, even when there is a high level of aggregated state ownership. To address this, we construct an alternative measure of state ownership focusing on the single largest state shareholder to examine the trade-off between the negative grabbing hand effects and the monitoring benefits of state owners. $Largest\ State\ Shares_t$ is the percentage of shares owned by the single largest state owner in a firm. We replace $State\ Shares_t$ and its squared term in Model (1) with $Largest\ State\ Shares_t$ and its squared term and report the results in Table 6.

Panel A reports the regression results using the full sample. Consistent with the results using the total proportion of state ownership, we find that the single largest state ownership also has a U-shaped impact on firm performance. Panel B reports the results regarding the introduction of strategic investors. Consistent with previous findings, we find that the U-shaped impact of single largest state ownership on firm performance is more salient before the introduction of strategic investors.

[Insert Table 6 here]

[18] Beijing General Research Institute for Non-ferrous Metals, which is a central SOE, owned 39.68% of shares in GRITEK.

[19] Tsinghua Unigroup, which is ultimately controlled by the Ministry of Education, owned 18.01% of shares in UGC. State-Owned Assets Supervision and Administration Commission of Hengyang Municipal Government owned 16.98% of shares. China National Traditional Chinese Medicine Corporation (SOE) owned 3.63% of shares. GUOLIAN Group (SOE) owned 1.11% of shares.

4.3.2. Block state owners

According to Ouyang et al. (2020) and Zhang and Li (2022), the Company Law of China describes that only shareholders who own more than 10% of the total shares can call interim shareholders' meetings. Therefore, shareholders who own at least 10% of total shares are defined as large shareholders in Chinese listed firms (Jiang et al., 2020; Zhong et al., 2021). Since large shareholders tend to have a more significant influence on firms than small shareholders, we re-run Model (1) using a modified sample that excludes observations where state ownership in total is less than 10% as an additional robustness check.

We report the results in Table 7. Panel A presents the regression results using the full sample, and Panel B presents the results regarding the introduction of strategic investors. Overall, we find that large state ownership has a U-shaped relation with firm market performance when proxied by Tobin's Q, and the relation is more pronounced before the introduction of strategic investors. However, we do not find significant results on accounting performance measured by ROA.

[Insert Table 7 here]

Overall, using alternative measures of state ownership in Tables 6 and 7, we find consistent results indicating a trade-off between the negative grabbing hand effects and the monitoring benefits of state owners, and the introduction of strategic investors moderates the impact of state ownership on firm performance.

4.4. Additional analysis

The U-shaped impact of state ownership on firm performance is likely to be the result of the trade-off between the negative effects of grabbing hand and the monitoring benefits of state owners. In this section, we aim to provide additional evidence concerning this argument.

4.4.1. Managerial opportunism

We first use earnings management as a proxy of managerial opportunism to examine whether and how internal governance is affected by different degrees of state ownership. As discussed by Jiang et al. (2020), earnings management is likely to be reduced if state shareholders play a monitoring role. Following Dechow et al. (1998) and Roychowdhury (2006), $Earnings\ Management_{i,t}$ is estimated as the abnormal production cost ($PROD_{it}$) minus abnormal operating cash flow (CFO_{it}) and abnormal discretionary expenses ($DISEXP_{it}$). The higher the value of $Earnings\ Management_{i,t}$, the higher the degree of managerial opportunism. The abnormal production cost ($PROD_{it}$), abnormal operating cash flow (CFO_{it}), and abnormal discretionary expenses ($DISEXP_{it}$) are the regression residuals from the following models:

$$\frac{PROD_{it}}{A_{it-1}} = a_0 + a_1\frac{1}{A_{it-1}} + a_2\frac{S_{it}}{A_{it-1}} + a_3\frac{\Delta S_{it}}{A_{it-1}} + a_4\frac{\Delta S_{it-1}}{A_{it-1}} + \varepsilon_{it}$$

$$\frac{CFO_{it}}{A_{it-1}} = b_0 + b_1\frac{1}{A_{it-1}} + b_2\frac{S_{it}}{A_{it-1}} + b_3\frac{\Delta S_{it}}{A_{it-1}} + \varepsilon_{it}$$

$$\frac{DISEXP_{it}}{A_{it-1}} = c_0 + c_1\frac{1}{A_{it-1}} + c_2\frac{S_{it-1}}{A_{it-1}} + \varepsilon_{it}$$

where A_{it} is the total assets at the end of period *t* in firm *i*, S_{it} is the sales of firm *i* in year *t*.

Table 8 reports the estimation results. Panel A refers to the full sample, we find that the coefficient on *State Shares* is positive at the 1% level, and the coefficient on *State Shares*^{2} is negative at the 1% level. Therefore, state ownership and earnings management have an inverted U-shaped relation. That is, the grabbing hand effect tends to outweigh the monitoring effect before state ownership reaches the threshold level. Consequently, increased ownership enables state owners to engage in more opportunistic activities for private benefits. When state ownership increases beyond the threshold level, state owners have stronger incentives to monitor firm management, which reduces opportunistic earnings management. Panel B reports

the subsample analysis regarding the introduction of strategic investors. However, we do not find any significant results.

[Insert Table 8 here]

4.4.2. Corporate governance

Additionally, we construct the corporate governance index (*CGI*) following Jiang and Yuan (2018) and Xu et al. (2017) to examine the impact of state ownership on corporate governance. We first construct six corporate governance variables for each firm-year observation in our sample: (1) the proportion of shares held by the top managers of the firm (*MShare*), (2) the proportion of shares held by institutional investors of the firm (*INShare*), (3) the natural logarithm of one plus the number of analysts covering the firm (*Analyst*), (4) the ratio of independent directors on the board (*Board Independence*), (5) a dummy variable that equals one if the firm issues B or H shares in the current year (*BHShare*), (6) a dummy variable that equals one if the firm is audited by one of the top eight accounting firms in the current year (*Audit*). The six variables have a positive impact on corporate governance, therefore, we sort all six variables in descending order in each year. We then generate the ranking of all firms accordingly for each variable based on year. The firm with the best governance performance gets the ranking of 1 for each ranking of the variable. Next, we divide the ranking by the total number of sample observations in each year and multiply the ratio by 100 to obtain a normalised value from 0 to 100. Lastly, a firm's CGI is calculated as the equally weighted average of all six rankings as follows:

$$CGI_{i,t} = \frac{1}{6}\sum_{j=1}^{6}(100 - \frac{Rank_{i,t,j} - 1}{Number\ of\ firms - 1} \times 100)$$

where j indicates the jth kind of corporate governance variable and $Rank_{i,t,j}$ indicates the ranking of the jth kind of corporate governance variable for firm i in year t. A higher value of $CGI_{i,t}$ indicates a better corporate governance performance for the firm.

We present the results in Table 9. Panel A reports the results using the full sample.[20] The coefficient on *State Shares* is negative at the 1% level, and the coefficient on *State Shares*^{2} is positive at the 1% level, indicating a U-shaped relation between state ownership and corporate governance performance. When state ownership is below the threshold level, we argue that state shareholders are less motivated to enhance corporate governance due to the grabbing hand effect, which negatively impacts corporate governance. However, as discussed, state shareholders may have stronger incentives to monitor firm management and better align their interests with firms when their ownership becomes sufficiently large, which improves corporate governance. Panel B reports the subsample analysis regarding the introduction of strategic investors. We find that state owners have a U-shaped impact on corporate governance before introducing strategic investors. However, for firms after introducing strategic investors, we find state owners have an inverted U-shaped impact on corporate governance. That is, state ownership is positively related to corporate governance before the threshold level, and the positive association changes to negative after state ownership becomes higher than the threshold level. In particular, we find that the threshold level of state ownership that changes the positive association to negative is around 88%, which is unavailable in our sample. Therefore, state ownership is likely to have a positive influence on corporate governance after the introduction of strategic investors.

[Insert Table 9 here]

Large shareholders may have an effective monitoring effect because they have stronger incentives and the power to monitor and discipline firm management at a lower cost (Nguyen et al., 2015; Shleifer & Vishny, 1986). Consistent with the literature, we find that large state ownership is associated with improved corporate governance before the introduction of strategic investors, whereas small state ownership does not exhibit the same effect. This

[20] We remove *Board Independence* from control variables because it is used in the construction of *CGI*.

supports our argument that the monitoring effect of shareholders is stronger than the grabbing hand effect of state when its stake becomes large. However, after the introduction of strategic investors, state ownership tends to have a positive association with corporate governance, even when state ownership is small. Overall, the results in Table 9 indicate that strategic investors may moderate the negative influence of state owners on firms.

4.5. Endogeneity: the IV 2SLS estimator

One concern associated with our analysis is that state ownership is not exogenous. It is possible that state ownership is correlated and affected by omitted variables that also affect firm performance. We have controlled for firm- and year-fixed effects to address unobserved firm- and year-specific characteristics, and in this section, we further mitigate our concern using the instrumental variable (2SLS) approach.

To construct the 2SLS analysis, two critical conditions are required to make instrumental variables valid. That is, instrumental variables must be correlated with the endogenous variable (e.g. state ownership) but not affect the dependent variables (for example, ROA). The literature indicates that it is difficult to find valid instrumental variables for state ownership, especially in the Chinese market. Existing studies such as Tian and Estrin (2008), Wei and Varela (2003), and Wei et al. (2009) use a dummy strategic industry variable as the instrumental variable because government ownership in the Chinese market is highly protected in industries such as energy, iron and steel, oil refinery and petrochemicals, machinery, and communications. However, the strategic industry effect may also be relevant to firm performance.

In this study, we use $Govt.Intervention\ Score_{i,t}$ as the main instrument for $State\ Shares_{i,t}$. $Govt.Intervention\ Score_{i,t}$ is constructed using the survey data collected

from the CGSS database from 2010 to 2018.[21] The CGSS database was jointly developed by Renmin University of China and Hong Kong University of Science and Technology in 2003 and collects data on social trends in mainland China, which can serve as the Chinese counterpart of the General Social Survey (GSS) in the U.S. (Niu & Zhao, 2018). We use the answer to three survey questions regarding each respondent's opinion on (1) whether the government should interfere in the criticism of the government, (2) how many children a person should have, and (3) the boundary-making process of the local citizenship system. The answer to the questions scores from one to five. The higher the score, the stronger the agreement on the opinion that the government should not interfere in the corresponding subjects. The details of the question are reported in Appendix A3. Studies such as Boubakri et al. (2015) and Boubakri and Saffar (2018) reveal that cultural differences affect government interventions. For instance, government intervention becomes less desirable in societies with individualistic cultures than in collectivist cultures. Consequently, governments are more likely to dilute state ownership in individualistic societies. To construct the IV in each year, we first aggregate scores of all three questions for each respondent in each province. We then calculate the provincial average scores as the $Govt.Intervention\ Score_{i,t}$. We expect that a higher provincial average score reflects a stronger regional individualistic culture. Therefore, firms located in provinces with high survey scores are likely to be associated with less state ownership. Since $Govt.Intervention\ Score_{i,t}$ is constructed based on the responses to the three survey questions averaged at the provincial level, it is unlikely to affect firm performance directly. Therefore, we argue $Govt.Intervention\ Score_{i,t}$ plausibly affects only $State\ Shares_t$ but not the dependent variables in Model (1).

[21] The CGSS data summarises the long-term trends of Chinese social changes estimated using large-scale survey questions on Chinese general social development.

If $State\ Shares_t$ is endogenous in the baseline analysis, its squared term $State\ Shares^2{}_{i,t}$ is endogenous, as well. We construct the second instrument for our analysis to satisfy the order condition that requires the number of instruments must at least equal the number of endogenous components. Motivated by Boubakri and Saffar (2018) that use the distance between the firm's location to the stock exchange as the instrument for state ownership, denoted $Ln(Distance)_{i,t}$. $Ln(Distance)_{i,t}$ is calculated as the natural logarithm of the distance in kilometres between firm *i*'s registered headquarter and the stock exchange that firm *i* is listed on. Kedia and Rajgopal (2011) show that a regulation is most effective when it is local, and they find the Securities and Exchange Commission have more influence on firms located closer to its offices. Similarly, Tang et al. (2018) find that the government tends to have a stronger influence on state-owned firms when they are close to administrative agencies. More importantly, China Securities Regulatory Commission (CSRC) is the sole regulator of two stock exchanges and a ministry-level agency of the State Council. However, according to Ma et al. (2010), the Chinese government authorities have a dual role in the securities market because they serve as both the regulator and owner of the stock exchanges. Since stock exchanges' decision-making power depends on the government-controlled regulatory system, Ma et al. (2010) argue that stock exchanges act as executive organisations of the government regulatory authorities. Therefore, we expected that firms located near its stock exchange would receive more influence from the government, thus, have higher state ownership.

We report the 2SLS analysis results in Table 10. Columns (1) and (2) refer to the first-stage regression of estimating the determinants of state ownership. We regress $State\ Shares_t$ on both $Govt.Intervention\ Score_{i,t}$ and $Ln(Distance)_{i,t}$ with other control variables in Model (1) and report the results in Column (1). Following Coles et al. (2012), we also conduct the estimation for the squared $State\ Shares_t$ and report the results in Column (2). Consistent with our expectation, $Govt.Intervention\ Score_{i,t}$ is negatively related to

$State\ Shares_t$ and its squared term. The results are significant at the 1% level, indicating a high level of government intervention leads to more state ownership. $Ln(Distance)_{i,t}$ is negatively and significantly related to $State\ Shares_t$ and its squared term, indicating the closer the firm is to the stock exchange, the stronger the government influence. The F-test of the excluded exogenous variables rejects the null hypothesis that the instruments are jointly weak. LR $\chi 2$ test also confirms the relevance of the instruments.

Columns (3) and (4) present the second-stage analysis concerning the main findings. We replace $State\ Shares_t$ and its squared term in Model (1) with their fitted values obtained from the first-stage regressions. We find that state ownership continues to have a U-shaped impact on ROA and Tobin's Q, and the results are significant at the 5% level and 1% level, respectively.

[Insert Table 10 here]

5. Conclusions

Using hand collected state ownership data, this study shows that the impact of state ownership on firm performance is driven by the trade-off between state owners' grabbing hand and monitoring incentives. We find that state shareholders tend to positively affect firms when their ownership is large. We argue this is due to reduced misalignment of interests between state and private shareholders and the increased monitoring incentives of state shareholders. In addition, this study goes beyond previous SIP work (e.g., Gunasekarage et al., 2007; Sun et al., 2003; Tian & Estrin, 2008; Wei & Varela, 2003; Wei et al., 2009) by incorporating the introduction of strategic investors. We find that the U-shaped impact of state ownership on firm performance diminishes after the introduction of strategic investors, which indicates that the introduction of strategic investors moderates firms' underperformance associated with the threshold state ownership levels. The impact of state ownership on firms is an ongoing debate

in the literature. This study provides new evidence showing how different degrees of state ownership affect firm performance.

We also provide implications for policymakers regarding how different policies shape the influence of state ownership on firms. Although the NTS reform mitigates the interest conflicts between state and non-state shareholders, we show that state shareholders may be free-riders and negatively affect firm performance when their shareholding stake is small. However, introducing strategic investors moderates the influence of state owners on firms, suggesting strategic investors may serve as a solution to mitigate the agency issues associated with state ownership.

This study has several limitations that can be explored in future research. First, due to data availability, our measurement of the impact of strategic investors is based on a dummy variable indicating the post-period after the introduction of strategic investors, which may not capture the nuanced impact of strategic investors' participation. Future studies can construct detailed identification of strategic investors, such as their investment types, horizons, and business strategies, to examine the impact of strategic investors. Second, we find that the introduction of strategic investors moderates the U-shaped impact of state ownership on firm performance. However, the detailed mechanisms through which firms with a mixed-ownership structure benefit from strategic investors need further analysis. Therefore, future research can investigate the role that strategic investors play in firms with mixed-ownership structures, thereby providing insights for policymakers on the promotion of the mixed-ownership structure.

Figure 1. The distribution of state ownership in the top 10 largest shareholders
Figure 1 illustrates the proportion of state shares and non-state shares held by the top 10 largest shareholders in Chinese listed firms from 2010 to 2019.

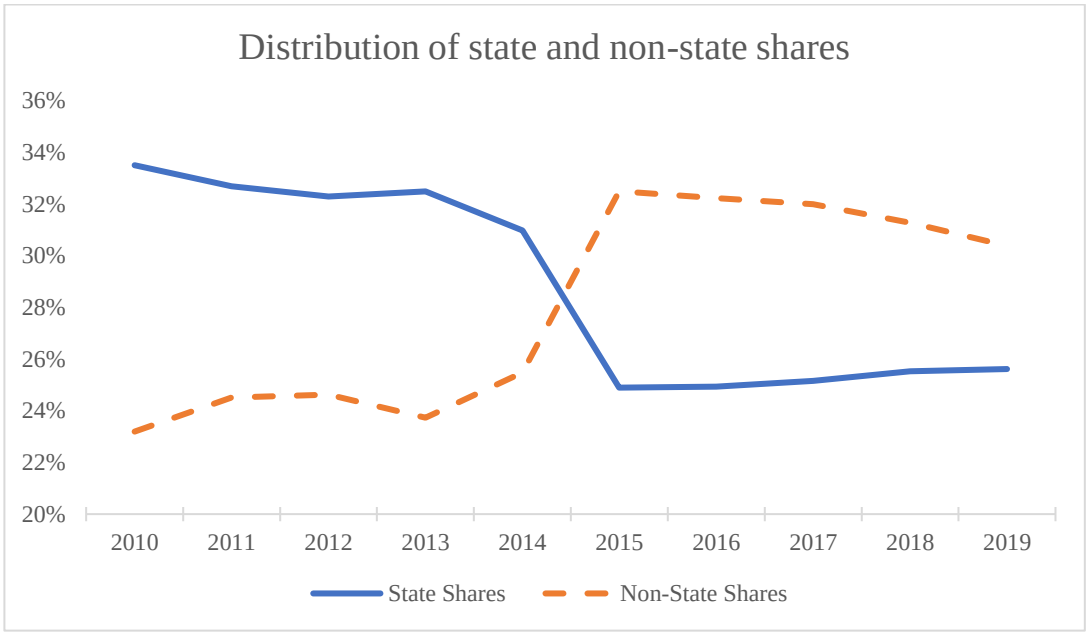

Figure 2. The relation between state ownership and firm performance

Figure 2 presents the U-shaped impact of state ownership on firm performance. State ownership is measured as the aggregated percentage of state shares among top 10 largest shareholders. *ROA* and *Tobin's Q* are proxies of firm performance and are defined in Appendix A1. The solid lines correspond to the predictions, whereas the capped spikes correspond to the 95% confidence intervals.

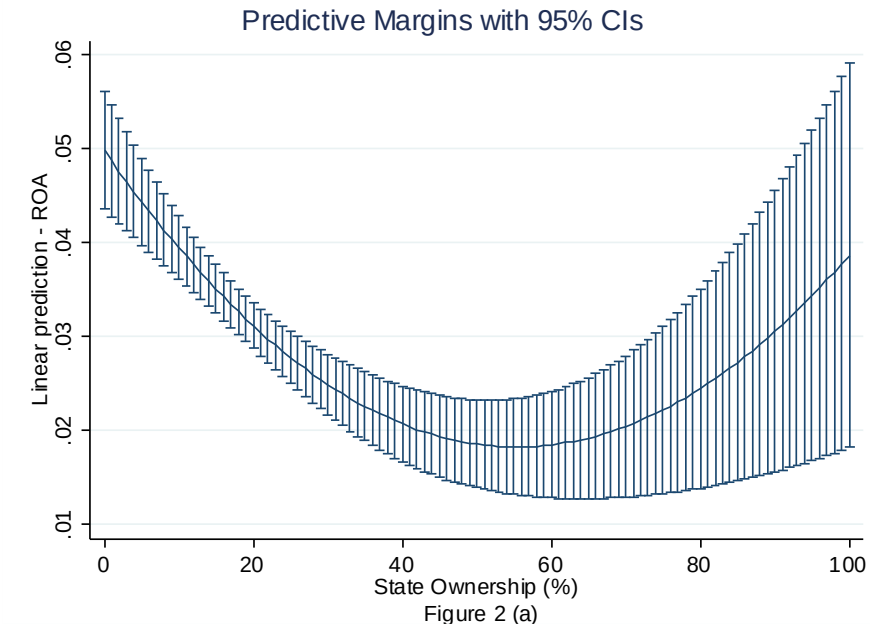

Figure 2 (a)

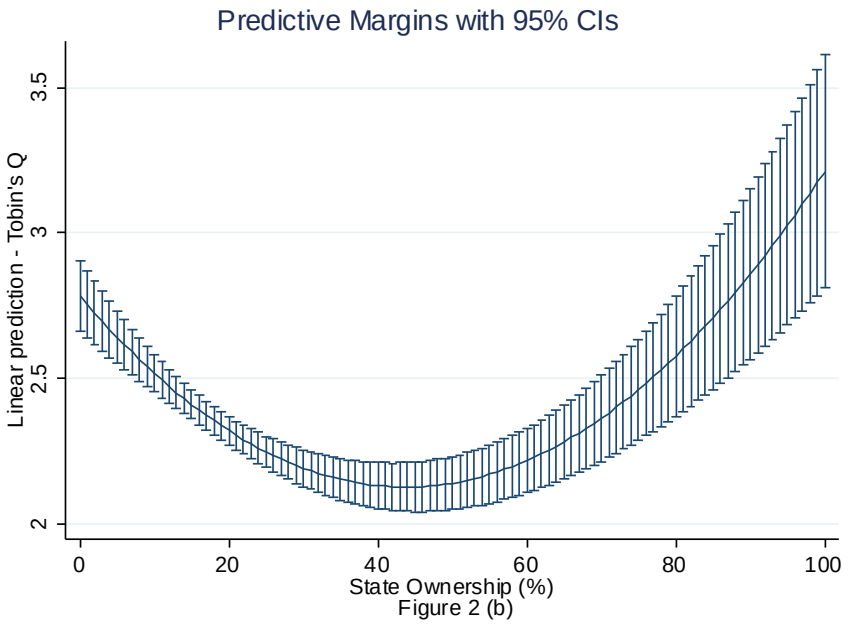

Figure 2 (b)

Table 1. Distribution of state ownership

Table 1 presents the distribution of state ownership. State ownership is measured as the aggregated percentage of state shares among top 10 largest shareholders. Panel A reports the distribution by year. Panel B reports the distribution by industry.

Panel A: Distribution of state ownership by year

Year	Obs.	Mean	Std. Dev.	P25	P50	P75
2010	995	33.50%	0.22633	9.75%	35.80%	51.60%
2011	1,049	32.69%	0.23218	8.11%	34.31%	51.53%
2012	1,094	32.29%	0.23616	6.93%	34.24%	51.31%
2013	1,071	32.49%	0.23603	6.81%	34.30%	51.61%
2014	1,112	30.98%	0.23695	3.93%	33.15%	50.27%
2015	1,439	24.90%	0.24322	1.84%	17.19%	46.48%
2016	1,408	24.93%	0.2394	1.94%	18.34%	46.37%
2017	1,435	25.16%	0.24154	2.08%	18.33%	46.25%
2018	1,370	25.52%	0.2413	2.24%	19.64%	46.21%
2019	1,405	25.62%	0.23959	2.44%	20.20%	46.27%
Total	12,378	28.29%	0.241	3%	28.02%	48.63%

Panel B: Distribution of state ownership by industry

Industry	Obs.	Mean	Std. Dev.	P25	P50	P75
Agriculture, forestry, animal husbandry and fishery	239	27.20%	0.222	3.40%	25.73%	44.80%
Mining industry	381	45.18%	0.250	28.10%	52.67%	62.85%
Manufacturing industry	7,766	24.14%	0.227	2.19%	18.35%	43.71%
Industry of electric power, heat, gas and water production and supply	565	50.74%	0.203	40.23%	54.02%	64.10%
Construction industry	311	28.61%	0.239	3.43%	29.35%	48.79%
Wholesale and retail industry	648	32.15%	0.216	7.67%	33.84%	48.97%
Transport, storage and postal service industry	492	46.62%	0.192	37.49%	51.11%	60.52%
Accommodation and catering industry	57	42.79%	0.167	32.48%	45.43%	51.55%
Industry of information transmission, software and information technology services	574	18.82%	0.219	1.84%	5.22%	38.37%
Real estate industry	614	31.77%	0.235	5.59%	32.02%	51.01%
Leasing and commercial service industry	168	36.11%	0.238	14.56%	33.93%	58.94%
Scientific research and technical service industry	59	34.44%	0.328	2.31%	17.41%	67.35%
Water conservancy, environment and public facility management industry	161	27.95%	0.224	5.39%	25.31%	46.41%
Industry of resident service, repair and other services	4	43.31%	0.188	32.30%	38.51%	54.32%
Education	14	25.04%	0.158	10.36%	23.13%	38.52%
Health and social work	14	3.13%	0.028	1.23%	1.99%	3.60%
Industry of culture, sports and entertainment	142	51.22%	0.267	44.18%	61.13%	69.45%
Diversified industries	169	26.49%	0.202	6.23%	22.44%	41.42%
Total	12,378	28.29%	0.241	3%	28.02%	48.63%

Table 2. Summary statistics

Table 2 presents the summary statistics of main variables used in this study. A detailed definition of all variables is reported in Appendix A1.

	Obs.	Mean	Std. Dev.	Min	Max
Dependent Variables					
ROA	12,378	0.032	0.067	-0.413	0.205
Tobin's Q	12,378	2.409	1.876	0.507	12.374
Controls					
State Shares	12,378	0.283	0.241	0.003	0.795
Foreign Shares	12,378	0.029	0.093	0.000	0.890
Firm Size	12,378	22.336	1.360	18.963	26.633
Firm Age	12,378	2.355	0.721	0.000	3.258
Leverage	12,378	0.466	0.220	0.054	1.369
CEO Age	12,378	3.899	0.125	3.466	4.159
CEO Gender	12,378	0.947	0.225	0.000	1.000
CEO Tenure	12,378	3.518	0.997	0.693	5.075
Duality	12,378	0.235	0.424	0.000	1.000
Female Director	12,378	0.129	0.113	0.000	0.455
Board Size	12,378	2.167	0.195	1.609	2.708
Board Independence	12,378	0.370	0.053	0.200	0.571
Provincial GDP Growth	12,378	0.104	0.062	-0.280	0.275

Table 3. Correlation Matrix

Table 3 reports the correlation matrix for main variables used in regression analysis. A detailed definition of all variables is reported in Appendix A1. *** indicates significance at the 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) *ROA*	1							
(2) *Tobin's Q*	0.106***	1						
(3) *State Shares*	0.003	-0.233***	1					
(4) *Foreign Shares*	0.091***	0.008	-0.089***	1				
(5) *Firm Size*	0.053***	-0.521***	0.339***	0.121***	1			
(6) *Firm Age*	-0.140***	-0.212***	0.298***	-0.128***	0.310***	1		
(7) *Leverage*	-0.374***	-0.270***	0.213***	-0.046***	0.392***	0.337***	1	
(8) *CEO Age*	0.031***	-0.041***	0.117***	0.072***	0.142***	0.105***	-0.019	1
(9) *CEO Gender*	-0.007	-0.013	0.068***	-0.022	0.018	0.006	0.009	0.025***
(10) *CEO Tenure*	0.059***	0.002	-0.146***	0.024***	0.007	0.009	-0.081***	0.201***
(11) *Duality*	-0.001	0.102***	-0.278***	0.044***	-0.110***	-0.167***	-0.087***	0.118***
(12) *Female Director*	-0.015	0.075***	-0.191***	-0.016	-0.119***	-0.063***	-0.070***	-0.023
(13) *Board Size*	0.023***	-0.138***	0.256***	0.010	0.232***	0.073***	0.128***	0.035***
(14) *Board Independence*	-0.024***	0.032***	-0.037***	0.062***	0.056***	0.025***	0.004	0.039***
(15) *Provincial GDP Growth*	0.052***	-0.000	0.064***	-0.006	-0.097***	-0.118***	0.032***	-0.097***

Table 3 (continued)

	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(9) *CEO Gender*	1						
(10) *CEO Tenure*	-0.025***	1					
(11) *Duality*	-0.015	0.086***	1				
(12) *Female Director*	-0.212***	0.048***	0.114***	1			
(13) *Board Size*	0.063***	-0.026***	-0.163***	-0.087***	1		
(14) *Board Independence*	-0.056***	0.023***	0.084***	0.020	-0.463***	1	
(15) *Provincial GDP Growth*	0.018	-0.117***	-0.048***	-0.076***	0.071***	-0.026***	1

Table 4. The relation between state ownership and firm performance

This table presents the regression results regarding the relation between state ownership and firm performance. The dependent variable is firm performance, which is measured by *ROA* and *Tobin's Q*. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. Detailed variable definitions are summarised in Appendix A1. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively.

	(1)	(2)
Variables	*ROA*	*Tobin's Q*
State Shares	-0.114***	-2.993***
	(-5.301)	(-7.132)
State Shares^2	0.103***	3.419***
	(3.971)	(6.765)
Foreign Shares	0.043**	0.810**
	(2.482)	(2.406)
Firm Size	0.021***	-1.142***
	(16.000)	(-45.308)
Firm Age	0.001	-0.187***
	(0.404)	(-4.047)
Leverage	-0.204***	0.084
	(-43.739)	(0.917)
CEO Age	-0.006	0.222*
	(-1.002)	(1.789)
CEO Gender	-0.004	-0.093
	(-1.037)	(-1.380)
CEO Tenure	0.001*	-0.021*
	(1.906)	(-1.799)
Duality	0.002	-0.038
	(1.183)	(-1.092)
Female Director	-0.006	0.017
	(-0.749)	(0.112)
Board Size	0.005	0.188*
	(0.844)	(1.674)
Board Independence	-0.024	0.651**
	(-1.418)	(1.971)
Provincial GDP Growth	-0.010	0.460**
	(-0.925)	(2.084)
Constant	-0.265***	27.282***
	(-6.937)	(36.522)
Reflection Point (% of State Shares)	55.34%	43.77%
Observations	12,378	12,378
Adjusted R-squared	0.441	0.726
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Table 5. The impact of strategic investors

This table presents the regression results regarding the moderating effect of strategic investors on the relationship between state ownership and firm performance. The dependent variable is firm performance, which is measured by *ROA* and *Tobin's Q*. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. Detailed variable definitions are summarised in Appendix A1. *t*-statistics are displayed in parentheses. * and *** denote the significance levels at 10% and 1%, respectively. n/a indicates there is no U-shaped relation.

	Strategic Investors = 0		Strategic Investors = 1	
	(1)	(2)	(3)	(4)
Variables	*ROA*	*Tobin's Q*	*ROA*	*Tobin's Q*
State Shares	-0.099***	-2.488***	-0.003	-1.656
	(-3.310)	(-4.232)	(-0.048)	(-1.482)
State Shares^2	0.086**	3.240***	0.006	1.831*
	(2.007)	(3.818)	(0.089)	(1.665)
Foreign Shares	0.065***	0.198	-0.038	4.086***
	(2.957)	(0.458)	(-0.949)	(5.848)
Firm Size	0.029***	-1.282***	0.021***	-0.802***
	(16.132)	(-36.042)	(8.389)	(-18.216)
Firm Age	0.010***	-0.105*	-0.004	-0.390***
	(3.301)	(-1.686)	(-0.486)	(-3.123)
Leverage	-0.227***	-0.179	-0.204***	0.260*
	(-35.448)	(-1.423)	(-23.024)	(1.699)
CEO Age	-0.005	0.322*	-0.016	0.210
	(-0.621)	(1.898)	(-1.406)	(1.104)
CEO Gender	-0.006	-0.267***	0.000	-0.124
	(-1.256)	(-2.793)	(0.042)	(-1.255)
CEO Tenure	0.001	-0.034**	0.000	0.005
	(1.136)	(-2.068)	(0.548)	(0.305)
Duality	0.002	-0.085*	0.001	-0.051
	(0.661)	(-1.718)	(0.223)	(-1.074)
Female Director	-0.004	0.080	-0.004	-0.088
	(-0.335)	(0.369)	(-0.349)	(-0.423)
Board Size	0.012	0.448***	0.012	0.177
	(1.381)	(2.723)	(1.333)	(1.154)
Board Independence	0.010	1.099**	-0.040*	-0.285
	(0.380)	(2.205)	(-1.650)	(-0.676)
Provincial GDP Growth	-0.016	0.313	-0.010	0.141
	(-0.874)	(0.864)	(-0.703)	(0.586)
Constant	-0.485***	29.197***	-0.274***	19.757***
	(-9.057)	(27.656)	(-3.753)	(15.670)
Reflection Point (% of State Shares)	57.56%	38.40%	n/a	n/a
Observations	8,257	8,257	4,121	4,121
Adjusted R-squared	0.439	0.732	0.510	0.746
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 6. The impact of the single largest state shareholder

This table presents additional tests of state ownership focusing on the impact of the single largest state owners. The dependent variable is firm performance, which is measured by *ROA* and *Tobin's Q*. *Largest State Shares* is measured as the percentage of shares held by the single largest state shareholder among top 10 largest shareholders. Detailed variable definitions are summarised in Appendix A1. Panel A reports the regression results using the full sample. Panel B reports the results regarding the introduction of strategic investors. *t*-statistics are displayed in parentheses. ∗, ∗∗, and ∗∗∗ denote the significance levels at 10%, 5%, and 1%, respectively. n/a indicates there is no U-shaped relation.

Panel A

	(1)	(2)
Variables	*ROA*	*Tobin's Q*
Largest State Shares	-0.104***	-3.380***
	(-4.244)	(-7.066)
Largest State Shares^2	0.121***	4.049***
	(3.784)	(6.485)
Foreign Shares	0.048***	0.788**
	(2.761)	(2.342)
Firm Size	0.020***	-1.138***
	(15.936)	(-45.749)
Firm Age	0.002	-0.187***
	(0.650)	(-4.065)
Leverage	-0.204***	0.087
	(-43.637)	(0.952)
CEO Age	-0.007	0.222*
	(-1.052)	(1.790)
CEO Gender	-0.004	-0.094
	(-1.040)	(-1.391)
CEO Tenure	0.001*	-0.021*
	(1.902)	(-1.845)
Duality	0.002	-0.038
	(1.257)	(-1.079)
Female Director	-0.006	0.018
	(-0.739)	(0.118)
Board Size	0.004	0.171
	(0.628)	(1.521)
Board Independence	-0.024	0.617*
	(-1.397)	(1.869)
Provincial GDP Growth	-0.010	0.484**
	(-0.881)	(2.189)
Constant	-0.261***	27.261***
	(-6.853)	(36.615)
Reflection Point (% of State Shares)	42.98%	41.74%
Observations	12,378	12,378
Adjusted R-squared	0.440	0.726
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Panel B				
	Strategic Investors = 0		Strategic Investors = 1	
	(1)	(2)	(3)	(4)
Variables	*ROA*	*Tobin's Q*	*ROA*	*Tobin's Q*
Largest State Shares	-0.118***	-3.675***	0.132**	-0.444
	(-3.324)	(-5.281)	(2.154)	(-0.420)
Largest State Shares^2	0.154***	5.354***	-0.105	0.346
	(2.747)	(4.868)	(-1.524)	(0.292)
Foreign Shares	0.066***	0.136	-0.029	4.028***
	(3.005)	(0.316)	(-0.716)	(5.785)
Firm Size	0.029***	-1.283***	0.021***	-0.789***
	(16.097)	(-36.300)	(8.381)	(-18.486)
Firm Age	0.011***	-0.103*	-0.003	-0.412***
	(3.366)	(-1.650)	(-0.443)	(-3.328)
Leverage	-0.226***	-0.173	-0.206***	0.270*
	(-35.399)	(-1.371)	(-23.189)	(1.761)
CEO Age	-0.006	0.312*	-0.016	0.214
	(-0.688)	(1.840)	(-1.433)	(1.124)
CEO Gender	-0.006	-0.261***	0.000	-0.125
	(-1.259)	(-2.732)	(0.038)	(-1.266)
CEO Tenure	0.001	-0.033**	0.000	0.004
	(1.144)	(-2.033)	(0.575)	(0.244)
Duality	0.002	-0.085*	0.001	-0.048
	(0.696)	(-1.734)	(0.206)	(-1.025)
Female Director	-0.004	0.085	-0.002	-0.103
	(-0.349)	(0.394)	(-0.159)	(-0.492)
Board Size	0.011	0.458***	0.013	0.160
	(1.283)	(2.791)	(1.435)	(1.044)
Board Independence	0.010	1.110**	-0.039	-0.301
	(0.400)	(2.228)	(-1.606)	(-0.713)
Provincial GDP Growth	-0.018	0.305	-0.010	0.142
	(-0.952)	(0.841)	(-0.708)	(0.591)
Constant	-0.480***	29.280***	-0.294***	19.325***
	(-8.969)	(27.806)	(-4.060)	(15.448)
Reflection Point (% of State Shares)	38.31%	34.32%	n/a	n/a
Observations	8,257	8,257	4,121	4,121
Adjusted R-squared	0.439	0.732	0.511	0.746
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 7. The impact of the block state shareholders

This table presents additional tests of state ownership focusing on the impact of the block state owners. The dependent variable is firm performance, which is measured by *ROA* and *Tobin's Q*. Firm-year observations with aggregated state ownership lower than 10% are removed in the analysis. *Block State Shares* refers to the aggregated state ownership that is higher than 10%. Detailed variable definitions are summarised in Appendix A1. Panel A reports the regression results using the full sample. Panel B reports the results regarding the introduction of strategic investors. *t*-statistics are displayed in parentheses. ∗, ∗∗, and ∗∗∗ denote the significance levels at 10%, 5%, and 1%, respectively. n/a indicates there is no U-shaped relation.

Panel A

	(1)	(2)
Variables	*ROA*	*Tobin's Q*
Block State Shares	-0.050	-3.679***
	(-1.439)	(-5.752)
Block State Shares^2	0.043	3.922***
	(1.185)	(5.828)
Foreign Shares	-0.040	3.710***
	(-1.362)	(6.802)
Firm Size	0.018***	-0.978***
	(11.560)	(-34.181)
Firm Age	0.001	-0.286***
	(0.391)	(-4.905)
Leverage	-0.192***	0.594***
	(-35.188)	(5.854)
CEO Age	-0.003	0.315**
	(-0.431)	(2.256)
CEO Gender	-0.003	-0.027
	(-0.794)	(-0.366)
CEO Tenure	0.000	-0.016
	(0.676)	(-1.404)
Duality	0.001	-0.038
	(0.456)	(-1.001)
Female Director	0.004	-0.038
	(0.428)	(-0.242)
Board Size	0.001	0.058
	(0.186)	(0.499)
Board Independence	-0.056***	0.224
	(-3.152)	(0.677)
Provincial GDP Growth	-0.010	0.454**
	(-0.803)	(2.054)
Constant	-0.207***	23.973***
	(-4.543)	(28.359)
Reflection Point (% of State Shares)	n/a	46.9%
Observations	7,636	7,636
Adjusted R-squared	0.497	0.732
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Panel B				
	Strategic Investors = 0		Strategic Investors = 1	
	(1)	(2)	(3)	(4)
Variables	*ROA*	*Tobin's Q*	*ROA*	*Tobin's Q*
Block State Shares	0.035	-5.043***	0.001	-1.696
	(0.587)	(-4.666)	(0.010)	(-1.504)
Block State Shares^2	-0.046	6.071***	0.002	1.868*
	(-0.681)	(4.971)	(0.034)	(1.685)
Foreign Shares	-0.046	3.622***	-0.038	4.085***
	(-0.787)	(3.385)	(-0.944)	(5.844)
Firm Size	0.025***	-1.285***	0.021***	-0.802***
	(8.573)	(-24.145)	(8.387)	(-18.209)
Firm Age	0.013**	-0.345***	-0.003	-0.391***
	(2.178)	(-3.265)	(-0.471)	(-3.129)
Leverage	-0.250***	0.901***	-0.204***	0.260*
	(-25.893)	(5.121)	(-23.023)	(1.701)
CEO Age	-0.000	0.457*	-0.015	0.210
	(-0.026)	(1.818)	(-1.402)	(1.103)
CEO Gender	-0.002	-0.254*	0.000	-0.124
	(-0.272)	(-1.791)	(0.038)	(-1.252)
CEO Tenure	-0.001	-0.049**	0.000	0.005
	(-0.791)	(-2.537)	(0.558)	(0.305)
Duality	-0.000	-0.099	0.001	-0.050
	(-0.047)	(-1.393)	(0.200)	(-1.066)
Female Director	0.038**	0.329	-0.004	-0.087
	(2.211)	(1.042)	(-0.364)	(-0.416)
Board Size	0.001	0.454**	0.012	0.177
	(0.097)	(2.122)	(1.326)	(1.157)
Board Independence	-0.020	0.845	-0.040*	-0.286
	(-0.591)	(1.366)	(-1.648)	(-0.677)
Provincial GDP Growth	-0.032	0.675	-0.010	0.141
	(-1.106)	(1.287)	(-0.706)	(0.587)
Constant	-0.397***	29.361***	-0.275***	19.768***
	(-4.560)	(18.488)	(-3.764)	(15.668)
Reflection Point (% of State Shares)	n/a	41.53%	n/a	n/a
Observations	3,522	3,522	4,114	4,114
Adjusted R-squared	0.539	0.775	0.500	0.747
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 8. State ownership and managerial opportunism

This table presents the results regarding the relation between state ownership and managerial opportunism. The dependent variable is managerial opportunism, which is proxied by *Earnings Management*. The higher the value, the higher the degree of managerial opportunism. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. Detailed variable definitions are summarised in Appendix A1. Panel A reports the results using the full sample. Panel B refers to the results regarding the introduction of strategic investors. *t*-statistics in parentheses. *** denotes statistical significance at the 1% level. n/a indicates there is no U-shaped relation.

Panel A

	(1)
Variables	*Earnings Management*
State Shares	0.219***
	(3.580)
State Shares^2	-0.247***
	(-3.359)
Foreign Shares	0.034
	(0.702)
Firm Size	0.021***
	(5.636)
Firm Age	-0.020***
	(-2.974)
Leverage	0.098***
	(7.377)
CEO Age	0.000
	(0.020)
CEO Gender	-0.012
	(-1.185)
CEO Tenure	0.000
	(0.100)
Duality	-0.010**
	(-2.052)
Female Director	-0.001
	(-0.051)
Board Size	0.022
	(1.330)
Board Independence	0.010
	(0.214)
Provincial GDP Growth	0.034
	(1.068)
Constant	-0.543***
	(-4.994)
Reflection Point (% of State Shares)	44.33%
Observations	12,378
Adjusted R-squared	0.412
Firm-fixed effects	Yes
Year-fixed effects	Yes

Panel B		
	Strategic Investors = 0	Strategic Investors = 1
	(1)	(2)
Variables	*Earnings Management*	*Earnings Management*
State Shares	0.096	0.034
	(1.201)	(0.161)
State Shares^2	-0.045	-0.206
	(-0.387)	(-0.994)
Foreign Shares	0.027	-0.060
	(0.457)	(-0.456)
Firm Size	0.017***	0.031***
	(3.543)	(3.774)
Firm Age	-0.010	-0.050**
	(-1.167)	(-2.132)
Leverage	0.108***	0.059**
	(6.281)	(2.051)
CEO Age	-0.006	0.011
	(-0.275)	(0.302)
CEO Gender	-0.024*	0.028
	(-1.873)	(1.519)
CEO Tenure	0.001	0.001
	(0.562)	(0.455)
Duality	-0.006	-0.022**
	(-0.824)	(-2.457)
Female Director	-0.017	0.009
	(-0.584)	(0.237)
Board Size	0.019	-0.001
	(0.834)	(-0.049)
Board Independence	0.012	-0.077
	(0.181)	(-0.973)
Provincial GDP Growth	0.070	0.033
	(1.415)	(0.730)
Constant	-0.436***	-0.616***
	(-3.040)	(-2.594)
Reflection Point (% of State Shares)	n/a	n/a
Observations	8,257	4,121
Adjusted R-squared	0.429	0.458
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Table 9. State ownership and corporate governance

This table presents the results regarding the relation between state ownership and corporate governance performance. The dependent variable is corporate governance, which is measured by the corporate governance index (*CGI*). The higher the value of *CGI*, the better corporate governance a firm is associated with. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. We remove *Board Independence* from controls because it is used as one component of *CGI*. Detailed variable definitions are summarised in Appendix A1. Panel A reports the results using the full sample. Panel B refers to the results regarding the introduction of strategic investors. *t*-statistics in parentheses. *** denotes statistical significance at the 1% level.

Panel A	
	(1)
Variables	*CGI*
State Shares	-9.457***
	(-4.544)
State Shares^2	16.625***
	(6.631)
Foreign Shares	7.900***
	(4.732)
Firm Size	3.795***
	(30.370)
Firm Age	-3.296***
	(-14.404)
Leverage	-7.373***
	(-16.320)
CEO Age	1.518**
	(2.466)
CEO Gender	0.145
	(0.436)
CEO Tenure	0.217***
	(3.809)
Duality	1.033***
	(5.943)
Female Director	-1.295*
	(-1.765)
Board Size	-11.355***
	(-23.325)
Provincial GDP Growth	2.150**
	(1.962)
Constant	-4.625
	(-1.307)
Reflection Point (% of State Shares)	28.44%
Observations	12,378
Adjusted R-squared	0.762
Firm-fixed effects	Yes
Year-fixed effects	Yes

Panel B		
	Strategic Investors = 0	Strategic Investors = 1
	(1)	(2)
Variables	*CGI*	*CGI*
State Shares	-9.595***	25.084***
	(-3.606)	(3.598)
State Shares^2	14.568***	-14.246**
	(3.792)	(-2.075)
Foreign Shares	8.712***	15.520***
	(4.463)	(3.560)
Firm Size	4.026***	2.860***
	(25.013)	(10.404)
Firm Age	-3.903***	-1.757**
	(-13.809)	(-2.256)
Leverage	-6.205***	-6.996***
	(-10.880)	(-7.337)
CEO Age	0.934	1.571
	(1.217)	(1.323)
CEO Gender	0.136	0.397
	(0.314)	(0.644)
CEO Tenure	0.226***	0.245***
	(3.034)	(2.656)
Duality	1.330***	0.762***
	(5.964)	(2.592)
Female Director	-1.276	1.795
	(-1.302)	(1.380)
Board Size	-12.410***	-11.765***
	(-19.392)	(-14.287)
Provincial GDP Growth	3.734**	-0.935
	(2.277)	(-0.625)
Constant	-5.202	4.144
	(-1.148)	(0.543)
Reflection Point (% of State Shares)	32.93%	88.04%
Observations	8,257	4,121
Adjusted R-squared	0.776	0.802
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Table 10. Two-stage least square regressions

This table presents the 2SLS regression analysis of the main results. Columns (1) and (2) refer to the first-stage regressions. *Govt. Intervention Score* and *Ln (Distance)* are IVs of state ownership. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. Columns (3) and (4) refer to the second-stage regressions, where dependent variables are *ROA* and *Tobin's Q*. Detailed variable definitions are summarised in Appendix A1. *t*-statistics are displayed in parentheses. ∗, ∗∗, and ∗∗∗ denote the significance levels at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)	(4)
Variables	*State Shares*	*State Shares*^{2}	*ROA*	*Tobin's Q*
Govt. Intervention Score	-0.036***	-0.021***		
	(-9.437)	(-7.769)		
Ln (Distance)	-0.003**	-0.003***		
	(-2.376)	(-3.208)		
Fitted State Shares			-2.026**	-119.545***
			(-2.480)	(-6.816)
Fitted State Shares ^{2}			3.486**	208.772***
			(2.445)	(6.821)
Foreign Shares	-0.231***	-0.165***	0.133***	7.155***
	(-11.006)	(-11.319)	(2.619)	(6.570)
Firm Size	0.048***	0.039***	-0.020	-3.586***
	(28.011)	(32.568)	(-1.228)	(-10.353)
Firm Age	0.063***	0.023***	0.051***	2.600***
	(20.719)	(10.887)	(2.687)	(6.429)
Leverage	-0.024**	-0.036***	-0.105***	4.691***
	(-2.406)	(-5.127)	(-3.341)	(6.926)
CEO Age	0.276***	0.171***	-0.048**	-2.577***
	(17.136)	(15.317)	(-2.107)	(-5.227)
CEO Gender	0.020**	0.013**	-0.009*	-0.559***
	(2.231)	(2.158)	(-1.922)	(-5.563)
CEO Tenure	-0.029***	-0.019***	0.007**	0.434***
	(-14.307)	(-13.390)	(2.068)	(5.879)
Duality	-0.099***	-0.059***	0.007	0.482***
	(-20.779)	(-17.851)	(1.270)	(3.961)
Female Director	-0.168***	-0.096***	-0.012	0.128
	(-9.420)	(-7.773)	(-1.105)	(0.556)
Board Size	0.146***	0.075***	0.036**	1.949***
	(12.406)	(9.233)	(2.505)	(6.244)
Board Independence	0.144***	0.120***	-0.138**	-7.037***
	(3.432)	(4.143)	(-2.419)	(-5.742)
Provincial GDP Growth	-0.063	-0.051*	0.039	3.562***
	(-1.641)	(-1.899)	(1.610)	(6.928)
Constant	-1.877***	-1.342***	0.662*	85.869***
	(-22.989)	(-23.684)	(1.655)	(9.999)
F-test (two IVs =0):				
F-value	44.94	30.35		
Prob > F	0.000	0.000		
LR χ2 test:				
LR chi2(2)	89.69	60.66		

Prob > chi2	0.000	0.000		
Observations	10,725	10,725	10,725	10,725
Adjusted R-squared	0.324	0.268	0.454	0.737
Firm-fixed effects	No	No	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Chapter Three

Essay Two

Chapter Three presents the second essay, which investigates the impact of political connections on stock price crash risk in the presence of government inspection influences. Introduction outlines the motivations, main findings, and contributions. Literature review and hypothesis development are then discussed. The section on sample and variables presents the sample and variable construction. Empirical results discuss the methodology and findings. The reference list is provided in the final section of this thesis.

Political connection and stock price crash risk: evidence from the environmental protection inspection

Abstract

This study examines whether firms with politically connected executives behave differently compared with those without such connections regarding information disclosure when under the government inspection influence. We find that firms with politically connected executives are generally associated with lower crash risk. However, these politically connected firms are more prone to crash risk than firms without political connections when subject to government inspection influences. Furthermore, we examine whether and how the inspection effect on crash risk varies by how executives develop their political connections (e.g., achieved or ascribed political connections). We find that when executives have achieved political connections, their firms are more likely to be crash-prone. Our findings remain consistent after a series of robustness tests, such as identifying inspection influences based on firms' office addresses, using multiple fixed effects, excluding the influences of "looking back" inspections, constructing the placebo test, and employing the propensity score matching analysis. In cross-sectional analyses, we find our baseline findings are more salient when firms are in regions with weak enforcement of environmental policies, when information asymmetry is high, for non-heavy polluters, when local officials are replaced, and when firms lack alternative channels of political connections. In addition, we find that the inspection batches in 2017 tend to have a stronger influence on corporate information disclosure behaviours. Overall, our study sheds light on the influence of managerial political connections on shaping firms' information environment.

1. Introduction

With the top-down political system (Wang et al., 2022; Zhang et al., 2022), the effectiveness of legislation in China heavily depends on local governments' actual enforcement (Tian et al., 2019). Consequently, there can be misalignment of interests between central and local governments regarding policy implementation (Zhang et al., 2018). For instance, large polluting firms may generate significant revenues and employment to benefit the local economy (Zhang et al., 2018), thereby inducing local officials to prioritise economic development over environmental protection and weaken the governance of polluting firms (Kou et al., 2022; Qi & Zhang, 2014; Zhang et al., 2022). To urge local governments to take effective measures to implement environmental regulations (Pan & Yao, 2021; Tian et al., 2019), the Ministry of Environmental Protection of China officially launched the environmental inspection program in January 2016, which aims to enforce environmental governance by sending central-government inspectors directly to each province to identify local environmental misconducts (Zhang et al., 2021b; Zhang et al., 2022).

Serving as a powerful external governance, government inspections are expected to improve the corporate information environment. Managers are found to increase information disclosure due to external pressure and scrutiny ((Pan & Yao, 2021; Zhang et al., 2021b). However, China is a relationship-based economy (Hu et al., 2020; Wang et al., 2021c), where political connection is a valuable resource for firms to obtain financial and policy preferential treatment (Faccio, 2006; Fan et al., 2007). For instance, politically connected firms have better access to external financing (Khwaja & Mian, 2005) and are associated with lower regulation violation costs (Fisman & Wang, 2015; Konisky & Teodoro, 2016). It is found that firms in China's new environmental inspector program (NEIP) cities are associated with lower crash risk than those in non-NEIP cities (Zhang et al., 2021b). However, due to the embeddedness of political influences in Chinese listed firms, it is still unclear how political connections affect

the corporate information environment. Particularly, there is a lack of evidence concerning whether politically connected firms behave differently than firms without political connections on information disclosure in the presence of campaign-style inspections.

This study examines whether and how politically connected executives affect corporate information flow when they are subject to government inspection influences, which in turn, influences future stock price crash risk (crash risk, hereafter). We aim to add new evidence to the literature on how government inspections affect the corporate information environment in a setting with strong political embeddedness. We link the government's environmental inspections with crash risk because crash risk is generally regarded as the result of managerial incentives of negative information hoarding (Gu et al., 2020; Habib et al., 2018; Jia, 2018; Kothari et al., 2009; Si & Xia, 2022). When the accumulated negative information reaches a tipping point, the sudden release of negative news to the market results in extremely negative stock returns and causes stock price crashes (Chen et al., 2018b; Hu et al., 2020; Kim et al., 2014).

We employ a sample of Chinese listed firms from 2014 to 2018 to answer the above question. We find that firms with politically connected executives behave differently compared with those without such connections concerning information disclosure when under the government inspection influence. Specifically, politically connected firms are more likely to be crash-prone when subject to inspection influences. Releasing negative information may attract more unwanted attention in politically connected firms, which increases reputational costs for politicians and their affiliated firms (Piotroski et al., 2015). As a result, politically connected managers are more likely to hide negative news in response to campaign-style enforcement due to the increased political costs introduced by political events. Besides, politically connected managers may lack incentives to improve information disclosure quality because political connections can provide extra government support or protection against

litigation risk and legal enforcement (Chaney et al., 2011; Li et al., 2019; Tee et al., 2021). A close relationship with the government induces managerial incentives to hide bad news at a low cost (Yu & Mai, 2020). Consequently, managers with political connections may hoard negative information instead of releasing such information in a timely manner in the presence of increased scrutiny.

Political connections with the government can be developed through different channels and relationship networks. Dang et al. (2022) and Zhang et al. (2016) suggest that different political ties indicate different business and government relationships. Therefore, we further distinguish between two types of political connections based on how they are developed. The first type of political connection refers to the situation when a firm's top executives have the experience of being appointed as the deputy of The National People's Congress or member of the Chinese People's Political Consultative Conference (CPPCC).[22] Such connections are defined as achieved political connections because executives are appointed due to their significant influence and successful achievements (Zhang et al., 2016). The second type of political connection refers to the case when a firm's top executives have government work experience as officials, which is defined as ascribed political connections. Compared with ascribed political connections developed through bureaucratic hierarchy, executives with achieved political connections are considered political "outsiders" because such connections are built through ongoing cooperation and favour exchange between corporations and the government (Dang et al., 2022; Zhang et al., 2016). As such, executives with achieved political connections have more pressure to please the government via actively implementing government initiatives, thus, are more sensitive to government inspections. Consistent with our

[22] The National People's Congress and CPPCC are the national legislative and political advisory bodies in China, respectively (Dang et al., 2022).

argument, we find that firms with achieved political connections are more prone to crash risk when subject to government inspection influences.

Furthermore, in our cross-sectional analyses, we find that firms with politically connected executives, particularly those with achieved political connections, are more prone to crash risk when subject to the government inspection influence in regions with weak enforcement of environmental policies, when information asymmetry is high, for non-heavy polluters, when local officials are replaced, and when they lack alternative channels of political connections. In addition, the inspection batches in 2017 tend to have a stronger influence on corporate information disclosure behaviours, suggesting learning from the first batch of inspections.

This study contributes to the literature in several ways. Tian et al. (2019) argue that political connection is an important yet understudied topic regarding the effectiveness of regulatory implementation. Since the inspection team represents the central government, it imposes strong political pressure on local governments and firms. However, it is still unclear if politically connected firms behave differently than firms without such connections in response to government inspections, although researchers find that political connection promotes green innovation (Zhang et al., 2022) and alleviates the negative market reaction to the inspection (Tian et al., 2019; Zeng et al., 2021). This study provides direct evidence of how political connections affect the corporate information environment when under government inspection influences. While the existing literature reveals that government inspections in general improve corporate information transparency (Zhang et al., 2021b), we find that firms with politically connected executives are associated with lower information transparency when there are government inspections. This finding provides insights that firm-level political connections may inhibit the efficiency of government regulatory policies and mechanisms. Our finding is more pronounced when executives have achieved political connections that are short-

tenured and subject to change, implying that executives' personal interests in political roles tend to be a driving factor affecting corporate information flow. Firms usually use political ties as a protection mechanism to obtain regulatory benefits (Tian et al., 2019). Our study reveals that firms with political connections may face more challenges in managing negative information, indicating that political connections may exacerbate the risk profile of firms when there are external shocks. Overall, this study provides insights into the complex relationship between political connections and corporate information environment in the presence of government inspections. It provides implications for policymakers concerning the importance of implementing regulatory policies in more efficient ways.

Despite the evidence that the inspection promotes corporate environmental activities (Pan & Yao, 2021; Wang et al., 2022; Zhang et al., 2022), there are still insufficient studies regarding the link between environmental enforcement and corporate non-environmental activities (Zhang et al., 2021b). Government inspections have been found to significantly influence earnings management (Zhang et al., 2021c), cash management efficiency (Tan et al., 2021), total factor productivity (Wang et al., 2021b), crash risk (Zhang et al., 2021b), and firms' stock value (Tian et al., 2019; Zeng et al., 2021). We add to the literature that firms with and without politically connected executives behave differently regarding information disclosure when under government inspections, showing that the inspections have a wider impact on corporate behaviour.

The remainder of the paper is organised as follows. Section 2 presents the literature and hypothesis development. Section 3 illustrates the data and sample construction. Section 4 reports the empirical analyses and results. Section 5 concludes.

2. Literature review and hypothesis development

2.1. Background of the environmental inspection in China

Most regulations, policies, and laws in China are designed based on the top-down political system (Wang et al., 2022; Zhang et al., 2022). That is, the central government possesses the top-level design and the supreme authority over policies, whereas local governments have been decentralised and are responsible for the enforcement and implementation of fundamental policies (Pan & Yao, 2021; Wang et al., 2022; Xu et al., 2020). However, since the effectiveness of legislation heavily depends on local governments' actual enforcement (Tian et al., 2019), there can be misalignment of interests between central and local governments regarding policy implementation (Zhang et al., 2018). Similar concerns have also been found in decentralising environmental regulations, including local governments' weak and ineffective enforcement (Lo et al., 2006; van Rooij, 2006). Existing studies argue that local officials' promotion is related to local economic development and performance (Blanchard & Shleifer, 2001; Li & Zhou, 2005; Li et al., 2020a; Wang et al., 2022). Therefore, local officials are incentivised to prioritise economic development over environmental development (Kou et al., 2022; Zhang et al., 2022). Since large polluting firms usually generate significant revenues and employment that benefit the local economy (Zhang et al., 2018), local governments may protect polluting firms to promote economic growth (Qi & Zhang, 2014). As a result, local governments may implement environmental regulations ineffectively and selectively.

To overcome the limitations associated with the top-down environmental governance, the government passed the *Central Environmental Protection Inspection Plan* (the Plan, hereafter) in the 14th Meeting of the Central Leading Group for China's Comprehensively Deepening Reform in July 2015. Following the Plan, the State Council established a leading

group, and the Ministry of Environmental Protection of China[23] carried out the detailed implementation (Wang et al., 2021d). The inspection team members are high-ranking officials from the departments of the CCCPC and central government institutions (Wang et al., 2021a). In particular, the inspection team is led by a team leader who is a minister-level official and a deputy leader who is the deputy minister of the Ministry of Environmental Protection (Kou et al., 2022). Other team members include central government officials, trained environmental inspectors, and environmental experts (Xiang & van Gevelt, 2020). Therefore, the inspection team represents the central government and is authorised to summon local officials, request relevant documents from local governments, hold public hearings, interview firm managers, and make unannounced on-site inspections (Kou et al., 2022). The inspection team can even prosecute regulation violators for severe environmental cases and dismiss local officials (Tan et al., 2021; Zhang et al., 2021b; Zhang et al., 2021c). Additionally, inspectors can request local governments to impose disciplinary sanctions on regulation violators through fines, rectification orders, administrative suspensions or demotions, and civil and criminal detention (Xiang & van Gevelt, 2020).

In 2016, the Ministry of Environmental Protection of China officially launched the environmental inspection program by sending central government environmental inspectors directly to provinces. As presented in Table 1, a total of five batches of inspections were conducted in different provinces since January 2016.[24] By the end of 2017, inspection teams completed the first round of inspection, covering all provinces. During the first round of inspection, inspection teams received more than 135,000 complaints from the public, punished 29,000 firms, and charged a total amount of 1.43 billion yuan in fines for environmental violations (Tan & Mao, 2021). In addition, 1,518 cases were filed for investigation, and 1,527

[23] It is now the Ministry of Ecology and Environmental of the People's Republic of China.
[24] For simplicity, provinces in this study also include autonomous regions and municipalities.

persons were detained (Wang et al., 2021a). Furthermore, since inspection teams not only oversee firms but also the main leaders in the inspected region, 18,448 local officials of the Party and government were summoned for interviews, 18,199 people were held accountable, and 2,230 cases of rectification work were assigned to local governments (Tan & Mao, 2021; Wang et al., 2021a; Xu et al., 2020). Following the first round of inspection, a "looking back" inspection was constructed in 2018 to revisit selected provinces. Subsequently, the second round of inspection commenced in 2019 and was completed in 2022.

[Insert Table 1 here]

As discussed in Zhang et al. (2021b), the inspection program is not a new regulation but a new approach to enforce existing regulations. The first round of environmental inspection strives for breakthroughs in environmental protection and captures the first instance where the central authority of China implemented standardised inspection measures for environmental protection (Li et al., 2020a; Wang et al., 2021a). The major objective of the program is to uncover and investigate the environmental misconduct of local governments (Zhang et al., 2022), monitor, and urge local governments to take effective measures to promote environmental protection (Pan & Yao, 2021; Tian et al., 2019).

2.2. The impact of the environmental inspection

The impact of environmental inspection has been widely discussed from the macro-level perspective. For instance, the environmental inspection facilitates the enactment of local environmental legislation (Ding et al., 2021; Xiang & van Gevelt, 2020), awakens public awareness and participation in environmental protection (Li et al., 2020a), improves environmental performance such as air quality and reduces pollutant discharge (e.g., Jia & Chen, 2019; Kou et al., 2022; Liu et al., 2022; Lu, 2022; Pan & Hong, 2022; Wang et al., 2021d; Xu et al., 2020).

As for corporate environmental behaviours, the literature reveals that the inspection reduces firm-level pollution (Wang et al., 2021a), promotes corporate green innovation (Zhang et al., 2022), and improves environmental investment (Wang et al., 2022). In addition, it has also been found that the inspection helps to improve firms' total factor productivity (Wang et al., 2021b) and enhance cash management efficiency (Tan et al., 2021). Recent studies also show that environmental inspections enhance corporate reporting and disclosure quality. For example, Zhang et al. (2021b) argue that the inspection enhances the external monitoring of corporate governance and find a negative relation between the inspections and stock price crash risk. Pan and Yao (2021) find that the inspection program improves environmental governance efficiency and results in better corporate environmental disclosure. Zhang et al. (2021c) demonstrate that firms engage in less earnings management due to the increased reputation cost of managers and increased visibility of the corporate operating environment following the inspections. Studies also examine how the capital market reacts to inspections. Firms will face more stringent supervision because of the inspection, which increases the compliance cost and the chance of being punished for environmental violations (Zeng et al., 2021), consequently leading to a negative impact of the inspections on stock value (Tian et al., 2019).

2.3. Hypothesis development

Managers may make firms less transparent by suppressing negative news due to different incentives (Jia, 2018). However, the hoarded information will be released to the public when it reaches a threshold and causes extremely negative returns, leading to stock price crash risk (Ben-Nasr et al., 2019; Callen & Fang, 2015; Chen et al., 2018b). Serving as an external governance, inspections have been found to promote corporate information transparency in general due to managers' concerns about increased scrutiny (Zhang et al., 2021b). In a relationship-based economy such as China (Hu et al., 2020; Wang et al., 2021c), it is common for firms to build up connections with the government in order to obtain preferential treatment

(Dang et al., 2022; Guo et al., 2021; Wei et al., 2020). Since existing studies indicate that political influence shapes the information flow of listed firms (Yu & Mai, 2020), firms with political connections may behave differently in response to government inspections than in normal times.

The literature reveals that politically connected firms are associated with lower crash risk during normal times (Chen et al., 2018a; Lee & Wang, 2016; Li & Chan, 2016). For example, one of the managerial incentives to hoard negative news is to convey firms' financial strength to attract capital providers (Burgstahler & Dichev, 1997). Claessens et al. (2008) and Li et al. (2020b) argue that political connections enhance firms' financial access and credibility, thereby providing additional insurance for firms' capital providers and reducing managerial incentives to hoard negative news. Meanwhile, the poor-mouth effect suggests that politically connected firms are incentivised to disclose more bad news. According to Li et al. (2020b) and Luo et al. (2016), resources are allocated to politically connected firms in an imbalanced way because the government tends to help firms in distress first. Consequently, to acquire government support, politically connected firms have weak incentives to hoard negative news during normal times, leading to lower crash risk.

However, due to external shocks, politically connected firms are more likely to be investigated than firms without political connections (Piotroski et al., 2015). Piotroski et al. (2015) find that Chinese firms with political connections restrict the negative information flow during political events because releasing such information may incur unwanted attention or even public scrutiny.[25] Therefore, releasing bad news about firms will result in higher political and reputational costs for politicians and their affiliated firms, particularly when there are campaign-style enforcements. Meanwhile, politically connected firms may obtain government

[25] Two political events are the National Congress of the Chinese Communist Party and the promotions of provincial officials, respectively.

support through rent-seeking activities and underground trades (Chen et al., 2018b; Li et al., 2019), which induces managerial incentives to hide bad information. Furthermore, a close relationship with the government may buffer firms from unwanted interferences and unfavourable regulations (Mellahi et al., 2015; Tee et al., 2021). For example, political connections can lower the costs associated with litigation risk and regulatory scrutiny (Chaney et al., 2011; Li et al., 2019). As a result, political connections can exacerbate information opacity and enable politically connected managers to hide bad news at a low cost in the presence of increased scrutiny (Lee & Wang, 2016; Yu & Mai, 2020).

The effectiveness of enforcement, rather than the regulation itself, plays a significant role in shaping firm behaviours (Jayaraman, 2012; Kimber & Lipton, 2016). For example, the literature reveals that the effect of insider trading laws on insider behaviour depends on enforcement, such as the toughness of the penalty (Bris, 2005; Chen et al., 2017; DeMarzo et al., 1998). Although the extra scrutiny associated with the inspections may promote corporate information transparency, politically connected firms are more likely to hoard negative news responding to the campaign-style enforcement to mitigate increased political and reputational costs. Consequently, politically connected firms tend to be more crash-prone than non-connected firms when under the inspection influence. As such, we propose the following hypothesis:

Hypothesis 1: Firms with politically connected executives are more likely to be crash-prone when they are subject to government inspections.

Since political connections can be developed through different channels, we further classify political connections into achieved connections when executives are appointed as the deputy of the National People's Congress or member of CPPCC and ascribed connections when executives have government work experience as officials. Firms with achieved political connections may behave differently than those with ascribed political connections because the

former build up connections with the government through more efforts and achievements (Zhang et al., 2016). Moreover, the appointment of the membership in the People's Congress or CPPCC is short-tenured and subject to renewal (Dang et al., 2022), and such executives have inadequate political power compared with government officials (Xiao & Shen, 2022). As argued by Dang et al. (2022), Dickson (2003), and Zhang et al. (2016), the government rewards entrepreneurs through membership in the People's Congress and CPPCC, which makes achieved political connections mainly the result of favour exchange between business and the government. In comparison, ascribed political connections are established via past working experience and have a more extensive political network with the government because they are established over time through the bureaucratic hierarchy (Dang et al., 2022). Achieved political connections normally are not relevant to executives' future political promotion as those executives have moved from the government sector to corporations.

Therefore, firms with achieved political connections are expected to be more sensitive to campaign-style enforcement because they face more pressure to maintain their close ties with the government, which makes them more likely to hoard the flow of negative information. On the contrary, firms with ascribed political connections have less pressure to please the central government (Wu et al., 2018). As such, we propose the following hypothesis:

Hypothesis 2: Firms with executives who have achieved or ascribed political connections behave differently in response to government inspections.

3. Sample and variables

3.1. Data and sample

The initial sample used in this study consists of all publicly listed Chinese firms on the Shanghai and Shenzhen Stock Exchanges. This study focuses on the impact of the first round of environmental inspection because of its strong randomness (Liu et al., 2022). Therefore, this study employs a sample period from 2014 to 2018 to include two years before the inspection.

The sample period ends in 2018 because the second round of inspection started in 2019. All firm-level financial data are obtained from the China Stock Market and Accounting Research (CSMAR) database. The inspection date is manually collected from the Ministry of Ecology and Environment of People's Republic of China (http://www.mee.gov.cn). Executives' political connections are manually collected from the background information of executives from the CSMAR database. After removing firms from the financial industry, firms that have been delisted, and observations with missing information, the final sample includes 1,353 firms from 2014 to 2018, corresponding to 5,710 firm-year observations from 15 industries. All continuous variables are winsorised at the 1% and 99% levels.

3.2. Variable construction

3.2.1. Stock price crash risk

Following prior studies such as Chen et al. (2001), Chen et al. (2018b), and Kim et al. (2011a, 2011b), we construct two measures of stock price crash risk using the weekly returns based on the extended market model as follows:

$$R_{i,t} = \alpha_i + \beta_1 R_{m,t-2} + \beta_2 R_{m,t-1} + \beta_3 R_{m,t} + \beta_4 R_{m,t+1} + \beta_5 R_{m,t+2} + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ is the return of stock *i* in week *t*, and $R_{m,t-2}$, $R_{m,t-1}$, $R_{m,t}$, $R_{m,t+1}$, $R_{m,t+2}$ are value-weighted market returns in weeks *t-2*, *t-1*, *t*, *t+1*, and *t+2*, respectively. We then estimate the firm-specific weekly return for firm *i* in week *t* ($W_{i,t}$) using the natural logarithm of one plus the residual obtained from Model (1) as follows:

$$W_{i,t} = \ln(1 + \varepsilon_{i,t}) \quad (2)$$

Two measures of crash risk are constructed based on $W_{i,t}$. The first measure of crash risk is the negative conditional skewness of firm-specific weekly returns (*NCSKEW*), which is calculated by taking the negative of the third moment of firm-specific weekly returns and dividing it by the standard deviation of firm-specific weekly returns to the third power. Specifically, for firm *i* in year *t*, *NCSKEW* is constructed as follows:

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

where $W_{i,t}$ is firm-specific weekly return and *n* refers to the number of weekly returns in year *t*. A larger value of *NCSKEW* indicates that stock returns have a more negatively skewed distribution, thus, higher crash risk.

The second measure of crash risk is down-to-up volatility (*DUVOL*). Specifically, for firm *i* in year *t*, firm-specific weekly returns are split into two groups: "down" weeks when the firm-specific weekly returns are lower than the annual average of $W_{i,t}$ and "up" weeks when the firm-specific weekly returns are higher than the annual average of $W_{i,t}$. *DUVOL* is calculated as the natural logarithm of the ratio of the standard deviations in the "down" weeks to the standard deviations in the "up" weeks. For firm *i* in year *t*, *DUVOL* is constructed as follows:

$$DUVOL_{i,t} = ln\{[(n_u - 1)\sum_{down} W_{i,t}^2]/[(n_d - 1)\sum_{up} W_{i,t}^2]\} \quad (4)$$

where n_u and n_d are the number of "up" and "down" weeks in year *t.* Similar to *NCSKEW*, a higher value of *DUVOL* indicates that a firm is associated with higher crash risk.

3.2.2. Government environmental inspection

Following the first round of environmental inspection initiated by the Chinese central government, five batches of inspections were carried out in different provinces from 2016 to 2017. Therefore, we construct a dummy variable (*Inspection*) which takes the value of one if firm *i* is headquartered in a province that is inspected in year *t* and thereafter, and zero otherwise.[26]

3.2.3. Political connections

Based on studies such as Chen et al. (2018b), Dang et al. (2022), Hu et al. (2020), and Zhang et al. (2016), we define a firm has political connections if the CEO or board chairperson

[26] If provinces are inspected at the end of the year, we define the following year as the inspection year.

has political experience. Specifically, we construct a dummy variable to measure the general political connection (*PC*), which equals one if the CEO or chairperson has past or current government working experience or political appointments to the People's Congress or the CPPCC, and zero otherwise. We also construct *Achieved PC* and *Ascribed PC*. *Achieved PC* refers to achieved political connection. *Achieved PC* is a dummy variable that takes a value of one if the CEO or chairperson of firm *i* has served or is currently serving as the deputy of the National People's Congress or member of CPPCC but has no working experience in government.[27] Otherwise, *Achieved PC* takes a value of zero. *Ascribed PC* represents ascribed political connection, which is measured as a dummy variable equal to one if a firm's CEO or chairperson has only past or current government working experience, and zero otherwise.[28] We consider both previous and current political experience following Chen et al. (2018b) that both past and concurrent work experience in government or political appointment contribute to political ties.

3.2.4. Control variables

Following the existing literature, we construct a set of variables that may affect crash risk (Chen et al., 2001; Chen et al., 2018b; Kim et al., 2011a, 2011b). Firms with high crash risk in the current year are likely to have high return skewness in the following year (Zaman et al., 2021). Hence, we control for contemporaneous crash risk for firm *i* in year *t*, which is *NCSKEW* or *DUVOL*. Investor heterogeneity has been found to be a predictor of crash risk (Li et al., 2017). Therefore, we construct detrended share turnover (*Dturn*), which is calculated as the difference in average monthly share turnover in year *t* and year *t-1*, where monthly share turnover is the monthly trading volume of shares divided by the total number of shares

[27] In our unreported analysis, we construct an alternative *Achieved PC* that equals one if the CEO or chairperson is the current member of People's Congress or CPPCC. We find similar baseline results as reported in this study.
[28] There are 171 observations with both achieved and ascribed political connections. We assign value zero to these observations in *Achieved PC* and *Ascribed PC.* In our unreported analysis, we use a refined sample removing 171 observations, we find consistent baseline results as reported in this study.

outstanding. According to Jia (2018), the bubble built up by past high returns can be followed by a sudden drop in stock price, and volatile stocks are more likely to be crash-prone. Thus, we control for *RET*, which refers to the average firm-specific weekly return over the fiscal year and *Sigma*, which represents the standard deviation of firm-specific weekly returns over the fiscal year. *BM ratio* is calculated as the ratio of the firm's book value to market value. *ABACC* is the absolute value of discretionary accruals, where discretionary accruals are estimated based on the modified Jones model (Dechow et al., 1995). *ROA* is the proxy of firm performance and is defined as the ratio of net income to total assets. *Firm size* is calculated as the natural logarithm of the firm's total assets. *Leverage* refers to the ratio of total debt to total assets. A high level of state ownership may induce firms to remain opaque due to political forces (Piotroski et al., 2015). Therefore, we construct *State Ownership*, which is calculated as the percentage of total state shares owned by the top 10 largest shareholders in firm *i*. Additionally, we control for the percentage of shares owned by the firm's largest shareholder (*Largest*) because Fan et al. (2007) argue that investors' rent-seeking incentives depend on the controlling shareholder's ownership stake in the firm. The detailed definitions of all variables used in this study are provided in Appendix B.

4. Empirical results

4.1. Descriptive statistics

We present the summary statistics of the main variables used in this study in Table 2. The mean values of $NCSKEW_{t+1}$ and $DUVOL_{t+1}$ are -0.288 and -0.200, respectively. The standard deviations of $NCSKEW_{t+1}$ and $DUVOL_{t+1}$ are 0.694 and 0.468, indicating significant variations in crash risk in our sample. The summary statistics in general are consistent with prior literature (e.g., Chen et al., 2018b; Yu & Mai, 2020). Concerning political connections, on average, 31.6% of firm-year observations in our sample are politically connected firms.

Additionally, 19.1% of observations have achieved political connections and 10.1% of observations have ascribed political connections.

We also present the correlation matrix of the main variables in Table 3.[29] The crash risk measures, $NCSKEW_{t+1}$ and $DUVOL_{t+1}$, are highly correlated with a correlation of 0.871 at the 1% significance level, suggesting two measures capture the same information regarding crash risk. $NCSKEW_{t+1}$ and $DUVOL_{t+1}$ also display significant relations with firm-level controls such as firm performance, share turnover, and stock return volatility, implying the significant influence of firm-level characteristics on crash risk and the importance of controlling these variables.

[Insert Tables 2 and 3 here]

4.2. Baseline regression results

To examine the impact of the government inspection on crash risk with respect to political connections, we construct Model (5) as follows:

$$Crash_{i,t+1} = \beta_0 + \beta_1 Inspection_{i,t} \times PC_{i,t} + \beta_2 Inspection_{i,t} + \beta_3 PC_{i,t} + \sum_k \beta_k Controls_{i,t} + Fixed\ Effects + \varepsilon_{i,t} \quad (5)$$

where $Crash_{i,t+1}$ is the proxy for stock price crash risk, measured by *NCSKEW* or *DUVOL*. $Inspection_{i,t}$ is a dummy variable representing the inspection effect as discussed. $PC_{i,t}$ and $Controls_{i,t}$ refer to the proxy for political connections and a set of control variables discussed above. Province-, industry-, and year-fixed effects are included to control for time-invariant location and industry influences and potential time trend effects.

Our variable of interest is the interaction term $Inspection_{i,t} \times PC_{i,t}$, which examines whether and how the impact of the inspection on crash risk differs in politically connected and

[29] We find that *RET* is highly correlated with *Sigma*, which is similar to studies such as Jia (2018), Kim et al. (2011b), Yu and Mai (2020), and Li et al. (2017).

non-politically connected firms. Based on *Hypothesis 1*, we expect the coefficient β_1 in Model (5) to be significantly positive.

Table 4 reports the results of Model (5). Columns (1) and (2) present the simplified model without control variables, Columns (3) and (4) present the full model with all control variables included. Consistently across all columns, we find the coefficients on *PC* in all columns are negative and significant at the 1% level. According to Chen et al. (2018b), Li et al. (2020b), and Luo et al. (2016), politically connected firms may have fewer incentives to withhold bad news at normal times. This is because resources are distributed in an imbalanced way to politically connected firms, as the government tends to help firms in distress as a priority (Li et al., 2020b). A poor-performed firm is more likely to leverage its government connections to acquire resources and government support (Luo et al., 2016). Consequently, politically connected firms tend to disclose more and not hoard bad news at normal times (Li et al., 2020b; Luo et al., 2016). Our finding of the negative coefficient on *PC* is in line with this argument. More importantly, the coefficients on $Inspection_{i,t} \times PC_{i,t}$ are all positive and significant, indicating that firms with politically connected executives are more prone to crash when subject to the government inspection influence compared with firms without such connections.

Additionally, we find that firms with high crash risk and high return volatility in the current year tend to have higher future crash risk. *ROA* and *Firm Size* are also positively related to future crash risk. On the other hand, firms with high *BM ratio* and *Leverage* are associated with lower crash risk. These results are in line with the literature, for example, Jia (2018), Xiao et al. (2022), and Zhou et al. (2021).

Overall, the results in Table 4 suggest that although firms with politically connected executives are generally associated with lower crash risk, they are more likely to hoard corporate information flow when subject to government inspection influences. This finding is

consistent with *Hypothesis 1*, implying politically connected firms tend to suppress negative information release due to increased political costs associated with the inspection.

[Insert Table 4 here]

To examine whether firms with different types of political connections behave differently regarding information disclosure in response to the inspection, we construct Model (6) as follows:

$$Crash_{i,t+1} = \beta_0 + \beta_1 Inspection_{i,t} \times Achieved\ PC_{i,t} + \beta_2 Inspection_{i,t} \times Ascribed\ PC_{i,t} + \beta_3 Inspection_{i,t} + \beta_4 Achieved\ PC_{i,t} + \beta_5 Ascribed\ PC_{i,t} + \sum_k \beta_k Controls_{i,t} + Fixed\ Effects + \varepsilon_{i,t} \quad (6)$$

where $Achieved\ PC_{i,t}$ and $Ascribed\ PC_{i,t}$ are proxies for achieved political connection and ascribed political connection as discussed. Other variables are the same as those used in Model (5). Similarly, we also include province-, industry-, and year-fixed effects. Following Dang et al. (2022) and Zhang et al. (2016), we include both interaction terms of $Inspection_{i,t} \times Achieved\ PC_{i,t}$ and $Inspection_{i,t} \times Ascribed\ PC_{i,t}$ in Model (6) to distinguish the influences of different types of political connections and report the results in Table 5.

Columns (1) and (2) refer to the results of Model (6) without control variables and Columns (3) and (4) present the full model results. In all four columns, we find that the coefficients on $Inspection_{i,t} \times Achieved\ PC_{i,t}$ are positive and significant, suggesting that firms with achieved political connections are more prone to crash risk when subject to the government inspection influence. On the other hand, the coefficients on $Inspection_{i,t} \times Ascribed\ PC_{i,t}$ across all columns are insignificant, implying that firms with ascribed political connections are less likely to hide negative news in response to the inspection. Similar to the results in Table 4, we find the coefficients on $Achieved\ PC_{i,t}$ are significantly negative in Columns (1) to (4), which indicates that firms with achieved political connections have fewer

incentives to withhold bad news at normal times (Chen et al., 2018b; Li et al., 2020b; Luo et al., 2016).

In support of *Hypothesis 2*, the results in Table 5 suggest that firms with different types of political connections behave differently regarding information disclosure in response to the inspection. Executives are rewarded with political appointments mainly for their economic or social influences. Because such appointments are short-tenured and subject to renewal and sudden change (Dang et al., 2022), CEOs or chairpersons with achieved political connections are more likely to delay the release of negative information when subject to the inspection influence to protect their reputation and maintain connections with the government. On the contrary, CEOs or chairpersons with ascribed political connections have less pressure to maintain connections with the government, which makes them less likely to suppress negative information release in comparison.

[Insert Table 5 here]

4.3. Robustness checks

The inspection effect in the baseline analysis is identified using cities based on firms' headquarters. However, it is possible that firms' operations and business activities are taking place in different cities. As a result, firms in cities where their office is are more directly affected by the inspection effect. Following the spirit of Giroud (2013), we re-identify the inspection effect and construct a dummy variable *Inspection Office* according to firms' office address. We replace *Inspection* in Model (5) and Model (6) with *Inspection Office* and report the regression results in Panel A of Table 6. The coefficients on $Inspection\ Office_{i,t} \times PC_{i,t}$ in Columns (1) and (3) are significantly positive, indicating politically connected firms are associated with higher crash when the inspection influences are identified using firms' office address. As reported in Columns (2) and (4), the coefficients on $Inspection\ Office_{i,t} \times Achieved\ PC_{i,t}$ are positive and significant. However, the coefficients on $Inspection\ Office_{i,t}$

× $Ascribed\ PC_{i,t}$ are statistically insignificant. This finding indicates that firms with achieved political connections tend to exhibit higher crash risk when the inspection influences are identified using firms' office address. Overall, our findings remain consistent after using firms' office address as robustness checks to identify the inspection influences.

To mitigate the influences of the time-invariant omitted firm-specific factors, we re-examine the regressions of Model (5) and Model (6) adding firm-fixed effects. Panel B of Table 6 shows that our main results hold after controlling for firm-fixed effects. Through Columns (1) to (4), we find that politically connected firms are associated with higher crash risk when subject to government inspection influences, particularly for firms with achieved political connections.

[Insert Table 6 here]

The inspection team also conducted a "looking back" inspection to re-visit some provinces in 2018. To mitigate the influence of the "looking back" inspection, we exclude firm-year observations from 2018 and re-estimate Models (5) and (6). We report the results in Table 7. Consistent with the baseline findings, we find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$ are significantly positive in Columns (1) and (3), and the coefficients on $Inspection_{i,t} \times Achieved\ PC_{i,t}$ are significantly positive in Columns (2) and (4). Our results still hold after excluding the influence of the "looking back" inspection.

[Insert Table 7 here]

To further address the influences of time-varying factors, such as the unexplored policy shocks and unobserved economic and social trends, we perform a placebo test following Dasgupta et al. (2018), Deng et al. (2021), Leung et al. (2019), and Tan et al. (2021). Specifically, we construct a placebo sample in each simulation by randomising the inspection year to each province. We then construct *Pseudo Inspection*, which is a dummy variable equal to one indicating the pseudo-post-inspection period, and zero otherwise. Finally, we perform

the regression analysis as specified in Models (5) and (6) using the simulated sample and repeat the simulation process 1,000 times.

We report the placebo test results in Table 8. Columns (1) and (3) present the mean values of the coefficient and *t*-statistic of $Pseudo\ Inspection \times PC$ after 1,000 times of simulation. The coefficients of the interaction terms are all insignificant, indicating politically connected firms do not affect crash risk differently compared with non-politically connected firms in response to the pseudo environmental inspection. Columns (2) and (4) present the simulation results regarding achieved and ascribed political connections and we find similar results. Overall, the placebo test implies that our main results are not driven by chance and unobserved shocks, which supports our hypothesis.

[Insert Table 8 here]

We also construct the parallel trend test concerning the impact of the inspections on crash risk. That is, firms' information disclosure follows a common trend before the inspection. Figure 1 presents the results of the parallel trend test. We use year indicators from -2 to 2 to represent the years from 2 years before to 2 years after the inspections. As illustrated, the 90% confidence intervals of each year's estimated coefficient in the pre-inspection period all pass through zero, implying there is no significant difference regarding crash risk in sample firms before the inspection. Therefore, the assumption of the parallel trend is likely to hold and verify the impact of the inspections.

[Insert Figure 1 here]

Lastly, we apply the propensity score matching (PSM) approach to mitigate the potential sample selection bias following studies such as Tan et al. (2021), Zhang et al. (2021b), and Zhang et al. (2021c). We match treatment firms (those in inspected provinces) with control firms (those in uninspected provinces). Specifically, to obtain the propensity score in the first

stage analysis,[30] we construct a logit model using *Inspection* as the dependent variable and the same set of firm characteristics in Model (5) as control variables. We employ one-to-one matching without replacement. After that, we re-estimate Models (5) and (6) using the PSM sample and report the results in Table 9.

Panel A of Table 9 presents the balance test of the PSM approach. We find that treatment and control groups have significant differences in most observable firm characteristics using the unmatched sample. However, the differences in firm characteristics between treatment and control groups become statistically insignificant using the PSM sample. As such, the treatment and control groups have similar observable firm characteristics after constructing the PSM. Panel B of Table 9 reports the regression results using the PSM sample, which are consistent with the baseline findings.

[Insert Table 9 here]

4.4. Subsample analysis

4.4.1. Regional environmental governance

As discussed, there can be misalignment of interests between central and local governments regarding policy implementation because the central government plays the guiding role and local governments play the executive role (Zhang et al., 2018; Zhang et al., 2020a; Zhang & An, 2018). Due to the imbalances between sustained economic growth and progressive reduction of industrial pollution (Imran et al., 2023), local governments may prioritise economic development over environmental protection and weaken the governance of polluting firms that usually contribute significantly to the local economy (Kou et al., 2022; Qi & Zhang, 2014; Zhang et al., 2018; Zhang et al., 2022). Consequently, politically connected firms in regions with different degrees of environmental governance may behave differently to the inspection.

[30] Results of the first stage analysis are not tabulated and available on request.

As a part of the governance of environmental pollution, the investment of industrial pollution control has been used to measure the degree of environmental regulation (Bian et al., 2019; Song et al., 2020; Zhang et al., 2020b). The higher the investment of industrial pollution, the better the industrial pollution control (Zhang et al., 2021a). Therefore, we first measure the degree of local environmental governance using the provincial investment of industrial pollution control that is adjusted by the secondary industry added value. As local governments control industrial pollution through supervision and punishment (Zhang et al., 2020a), a higher investment of industrial pollution control indicates a stronger degree of environmental governance in the corresponding province. We construct a subsample analysis using the annual median value of the provincial investment of industrial pollution control and divide the full sample into two groups, *Strong Environmental Governance* and *Weak Environmental Governance.*

We report the results in Table 10. Columns (1) to (4) refer to firms in regions with strong environmental governance. We find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$, $Inspection_{i,t} \times Achieved\ PC_{i,t}$, and $Inspection_{i,t} \times Ascribed\ PC_{i,t}$ are all insignificant through Columns (1) to (4). Columns (5) to (8) refer to firms in regions with weak environmental governance and we find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$ and $Inspection_{i,t} \times Achieved\ PC_{i,t}$ are all positive and significant, indicating politically connected firms are more likely to be crash-prone due to inspection influences if they are in regions with weak environmental governance.

[Insert Table 10 here]

We also measure the degree of environmental governance using the total number of environmental misconduct cases identified by the inspection team. A province with more environmental misconduct cases tends to have weaker environmental governance than provinces with fewer misconduct cases. Therefore, we divide the full sample into two groups

using the annual median value of the number of environmental misconduct cases. *More (Fewer) Misconduct Cases* represent firms located in provinces with more (fewer) misconduct cases relative to the annual median level. We report results in Table 11 and find that politically connected firms in regions with more misconduct cases are associated with higher crash risk when subject to the government inspection influence as illustrated in Columns (1) to (4).

[Insert Table 11 here]

Overall, Tables 10 and 11 indicate that weak local policy implementation tends to induce managerial incentives to hide bad news.

4.4.2. Ownership structure

Since the government still dominates resource allocation (Chen et al., 2011), political networking may become crucial for non-SOEs because such connections can serve as a substitute for inadequate institutional support (Li & Zhang, 2007). For example, according to Dang et al. (2022), credit allocation is biased in favour of SOEs, exacerbating financial constraints of firms without political connections. In comparison, being ultimately controlled by the government, SOEs have more natural advantages because they are connected to the government via state ownership. Consequently, the sensitivity of politically connected executives to the inspections may differ in SOEs and non-SOEs. To verify this conjecture, we construct the subsample analysis concerning the identity of the controlling shareholder of listed firms and report the results in Table 12.

Columns (1) to (4) refer to the results in non-SOEs. We find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$ are positive and significant in Columns (1) and (3), showing that non-SOEs with politically connected executives tend to be more crash-prone when they are subject to the inspection influence. We also find that the coefficient on $Inspection_{i,t} \times Achieved\ PC_{i,t}$ in Column (2) is positive and significant. Columns (5) to (6) refer to the results in SOEs, we find the coefficients on $Inspection_{i,t} \times PC_{i,t}$ and $Inspection_{i,t} \times$

$Achieved\ PC_{i,t}$ are also positive and significant. We further test the statistical significance of the coefficients on $Inspection_{i,t} \times PC_{i,t}$ and $Inspection_{i,t} \times Achieved\ PC_{i,t}$ between non-SOEs and SOEs, we find the coefficients in two groups are not statistically different.[31] Therefore, our baseline findings do not vary by a firm's ownership type.

[Insert Table 12 here]

4.4.3. Information transparency

Lacking information transparency enables managers to hide firm-specific negative news (Chen et al., 2018b; Hu et al., 2020; Yu & Mai, 2020). If our main findings are subject to information asymmetry, we expect that politically connected firms with lower information asymmetry are less likely to be crash-prone following the inspection because better information transparency can restrict the managerial capability to hide negative information.

We construct a proxy for information asymmetry following Chen et al. (2018b) and Cui et al. (2016), which is measured by the annual average of the monthly analyst forecast dispersion. Specifically, analyst forecast dispersion is calculated as the standard deviation of analysts' forecast of earnings per share (EPS) in each month scaled by the absolute value of the mean forecast. Lower forecast dispersion indicates lower information asymmetry. We then identify the median value of analyst forecast dispersion for each industry-year, by which we divide the full sample into two groups, *Low Information Asymmetry* and *High Information Asymmetry*.

Table 13 reports the results of Models (5) and (6) in different information environment. We do not find any significant result on the interaction terms in Columns (1) to (4), indicating politically connected firms with lower information asymmetry are less likely to hide negative news even when subject to government inspection influences. However, for firms with higher information asymmetry as presented in Columns (5) to (8), we find significant results

[31] Results of the significant test of coefficients are not tabulated but available upon request.

indicating that firms with politically connected executives are more crash-prone when they face the inspection influence, particularly for firms with achieved political connections.

Overall, our findings indicate that politically connected executives' incentives to hide negative information are more pronounced in firms with low transparency, which aligns with the argument that lack of information transparency enables managers to hide firm-specific bad news (Chen et al., 2018b).

[Insert Table 13 here]

4.4.4. External monitoring

Weak external monitoring mechanisms can result in severe agency conflicts (Callen & Fang, 2015). Therefore, we aim to investigate whether external monitoring could be another potential channel that affects the information disclosure behaviour of firms with politically connected executives. In particular, we divide the full sample into two groups regarding whether a firm is identified as a heavy polluter. Cho and Patten (2007) argue that environmentally sensitive firms tend to be associated with more market scrutiny than environmentally insensitive firms. The heavy polluter is identified by the local administrative department of environmental protection based on firms' operation and pollutant discharge.[32] The list is updated annually, and firms on the list are more environmental-sensitive and are subject to more information disclosure and supervision. As such, firms belonging to non-heavy polluters are associated with less external monitoring compared with heavy polluters.

Table 14 reports the results. Except for Column (4), we find that firms with politically connected executives are not associated with higher crash risk in the presence of inspection influence when they are heavy polluters. However, as in Columns (5) to (8), politically connected firms are prone to crash risk when they are non-heavy polluters after the inspection.

[32] For example, the State Environmental Protection Administration releases the list of key monitoring enterprises (http://www.gov.cn/zfjg/content_566589.htm, in Chinese).

Our results indicate that firms with politically connected executives are more likely to delay the negative information release following the inspection when there is insufficient external monitoring.

[Insert Table 14 here]

4.4.5. Local officials' turnover

If managerial incentives to hinder information flow in our study is due to the reason of increased reputational cost and managers' incentives to maintain close ties with the government, we expect that politically connected managers are more likely to hoard negative news to maintain a good image when there are government official turnovers. Therefore, we construct a dummy variable *Official Turnover* which equals one if there is a local official turnover in the current year, and zero otherwise.[33]

We present the results in Table 15. Columns (1) to (4) represent firms in provinces with no official turnovers, whereas Columns (5) to (8) refer to firms in provinces with official turnovers. We do not find significant difference regarding general political connections in both groups as the coefficients on $Inspection_{i,t} \times PC_{i,t}$ are significantly positive in Columns (1) and (7). However, we find that firms with achieved political connections are associated with higher crash risk when they are in provinces with official turnovers. As discussed, achieved political connections are subject to renewal, such connections tend to be more sensitive to political events. Our finding provides some evidence that politically connected managers may hide negative news for political incentives. Our finding is also in line with Piotroski et al. (2015), who find that firms suppress negative information when there is local-level political promotion.

[Insert Table 15 here]

[33] We focus on the provincial party secretary and governor because they are the top two officials in a province.

4.4.6. Indirect political connections

In this section, we examine whether and how our baseline findings are affected by invisible political connections. We have shown that managerial political connection shapes corporate information flow due to government inspection influences. However, firms may develop political connections through other indirect channels that affect our findings. Since administrative expenses are widely used at the managers' discretion (Luo et al., 2011), abnormal management expenses (AMEs) can be used to facilitate corporate public relationships (Liu et al., 2016). Therefore, we use AMEs as the proxy for the invisible channel of political connections. Following Anderson et al. (2022) and Liu et al. (2016), we use the residuals estimated from the following model to estimate AMEs:

$$Mexpense_{i,t} = \partial_0 + \beta_1 \Delta Sale_{i,t} + \beta_2 PPE_{i,t} + \beta_3 Inve_{i,t} + \beta_4 LnEmployee_{i,t} + \mu_{i,t} \quad (7)$$

where $Mexpense_{i,t}$ is the management expenses, $\Delta Sale_{i,t}$ is the change in sales, $PPE_{i,t}$ is the net fixed assets, and $Inve_{i,t}$ is inventories for firm *i* in year *t*, respectively. All these variables are scaled by one-year lagged total assets for the firm. $LnEmployee_{i,t}$ is the natural logarithm of the number of employees for firm *i* in year *t*.

We divide the full sample into two groups based on each industry's annual median value of AMEs and report the results in Table 16. Columns (1) to (4) represent firms with higher AMEs, which may have developed political connections through indirect channels other than managerial connections. The coefficients of the interaction terms between inspection effect and political connection are all statistically insignificant. Columns (5) to (8) refer to firms with lower AMEs, which tend to have fewer alternatives of managerial connections. We find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$ and $Inspection_{i,t} \times Achieved\ PC_{i,t}$ are all positive and significant.

The results in Table 16 are consistent with our conjecture that invisible channels of political connections affect managerial incentives of information hoarding. When there are

insufficient channels of public connections, managers tend to have greater pressure to maintain the existing ties through their personal connections. Consequently, they are more likely to restrict the information flow compared with managers in firms with other alternatives of connections.

[Insert Table 16 here]

4.4.7. 2016 and 2017 inspections

As discussed, the first round of inspection consists of five batches from 2016 to 2017. Therefore, we split sample firms into two groups based on the inspection year. We aim to investigate the separate impact of 2016 and 2017 batches to obtain a clearer picture of the inspection influence. Specifically, *2016 Batches* includes firms located in provinces that were inspected in 2016, whereas *2017 Batches* includes firms located in provinces that were inspected in 2017. We present the results in Table 17. Columns (1) to (4) refer to firms in provinces that were inspected in 2016, whereas Columns (5) to (8) refer to firms in provinces that were inspected in 2017. Interestingly, we find that the coefficients on $Inspection_{i,t} \times PC_{i,t}$ and $Inspection_{i,t} \times Achieved\ PC_{i,t}$ are only significant and positive in Columns (5) to (8) where firms are in provinces inspected in 2017.

The effectiveness of enforcement plays a more significant role than the regulation itself (Kimber & Lipton, 2016). It is possible that due to the randomness of the inspection, firms in the *2016 Batches* do not have time to manage the information flow. It is also possible that firms in provinces inspected in 2016 lack the predecessors to learn from. However, in the case of firms in provinces inspected in the 2017 batches, they can learn from the 2016 batches regarding the rigour of the inspection. For example, Jiangsu province was inspected in July 2016. By November 2016, 2,712 firms were ordered to rectify, 1,384 cases were filed for punishment, with a total penalty amount of 97.5 million yuan. In addition, 108 people were

detained, 618 people were interviewed,[34] and 449 people were held accountable. Jiangsu Nhwa Pharmaceutical Co.,Ltd. (002262) is a listed pharmaceutical company in Jiangsu province. Due to the air pollution issues investigated by the inspection team, Nhwa was ordered to immediately cease production on the pharmaceutical project production line and was fined 100,000 yuan in July 2016. Sinoma Pingxiang Cement Co., Ltd is a subsidy of Sinoma Science & Technology Co Ltd (002080). Following the inspection of Jiangxi province in July 2016, Sinoma Pingxiang Cement Co., Ltd was fined 500,000 yuan for environmental misconduct and the case was subsequently referred to the local public security bureau for further investigation. As a result, the person directly responsible for the company was detained. The environmental inspection marks an unprecedented campaign that the Chinese central authority applied formalised inspection requirements to environmental protection for the first time (Jia & Chen, 2019; Wang et al., 2021a). Consequently, given the knowledge obtained from the 2016 inspections, firms that were subject to inspections in 2017 could potentially be more impacted and better prepared to manage the information flow accordingly. As such, firms subject to 2017 inspections are more likely to be crash-prone.

[Insert Table 17 here]

4.5. Additional test

As discussed, there can be misalignment of interests between central and local governments regarding policy implementation (Zhang et al., 2018). While the central government aims to enforce environmental governance, local governments may protect polluting firms to prioritise economic development (Kou et al., 2022; Zhang et al., 2022). Therefore, we examine if our baseline findings vary by whether political connections are developed at the local or central level in this section. If local governments protect local

[34] Interview refers to the authorities with specific administrative powers holding discussions, studying policies and regulations, analysing and commenting, and using other methods to rectify and standardise the issues existing in the operation of subordinate organisations through quasi-specific administrative actions.

polluting firms, they may work with local firms to hoard negative news. As such, we expect firms with connections to local governments to be associated with higher crash risk compared to firms with connections to the central government.

We report the results in Table 18. *Central PC*, *Central Achieved PC*, and *Central Ascribed PC* in Columns (1) to (4) are dummy variables representing executives' political connections developed at the central level, respectively. *Local PC*, *Local Achieved PC*, and *Local Ascribed PC* in Columns (5) to (8) are dummy variables representing executives' political connections developed at the local level, respectively. However, we find the coefficients on *Inspection * Central PC*, *Inspection * Central Achieved PC*, *Inspection * Local PC*, *Inspection * Local Achieved PC* are all positive and significant. We further test the statistical significance of the coefficients of the above interaction terms between central and local levels, we do not find significant difference.[35] Therefore, the results indicate that firms with politically connected executives are associated with higher crash risk when subject to government inspection influences, no matter such connections are developed at central or local levels.

[Insert Table 18 here]

5. Conclusion

Prior studies (e.g., Pan & Yao, 2021; Zhang et al., 2021b) find that external pressure and scrutiny can restrict managerial incentives to hide firm-specific negative information. However, it is still unclear how political connections affect corporate information flow in the presence of government inspections in relationship-based economies such as China. To answer this question, this study investigates whether firms with and without politically connected executives behave differently when there are government inspection influences.

[35] Results of the significant test of coefficients are not tabulated but available upon request.

We find that although firms with politically connected executives are associated with lower crash risk in general, such politically connected firms are more prone to the risk of stock price crashes when subject to the inspection influence. Compared with firms without politically connected executives, firms with politically connected executives are associated with higher political and reputational costs and tend to be more sensitive to campaign-style enforcement. Consequently, firms with politically connected executives are more likely to hide negative information responding to the inspection and become crash-prone.

We further distinguish political connections regarding achieved and ascribed political connections. We find that only firms with achieved political connections are prone to crash risk. Achieved political connections are short-tenured and subject to sudden change because they are developed as a reward for managers' success or achievement. Consequently, firms with achieved political connections face more pressure to please the government when subject to inspection influence, and therefore tend to hoard the flow of negative news.

We also construct cross-sectional analyses to examine factors that may influence our findings. We find that firms with politically connected executives, particularly those with achieved political connections, are associated with higher crash risk when subject to the influence of government inspection in regions with weak enforcement of environmental policies, when information asymmetry is high, when firms are non-heavy polluters, when local officials are replaced, and when firms lack alternative channels of political connections. We also compare inspection batches in 2016 and 2017. Our results indicate that the inspection batches in 2017 have a stronger impact on corporate information disclosure behaviours.

Overall, this study highlights the impact of political connections on managerial incentives regarding information disclosure, which in turn, affects stock price crash risk. Our findings also indicate that politically connected firms are associated with greater challenges in managing negative news because political connections may exacerbate the risk profile of firms

in the presence of increased scrutiny. This study provides implications to policymakers and investors regarding the relationship between political connections, government inspections, and corporate information environment.

Figure 1. Parallel trends test of the inspection

Figure 1 presents the results of the parallel trend test regarding the inspection. t-2 to t+2 represent years before and after the inspections. The dashed lines with cap represent 90% confidence intervals.

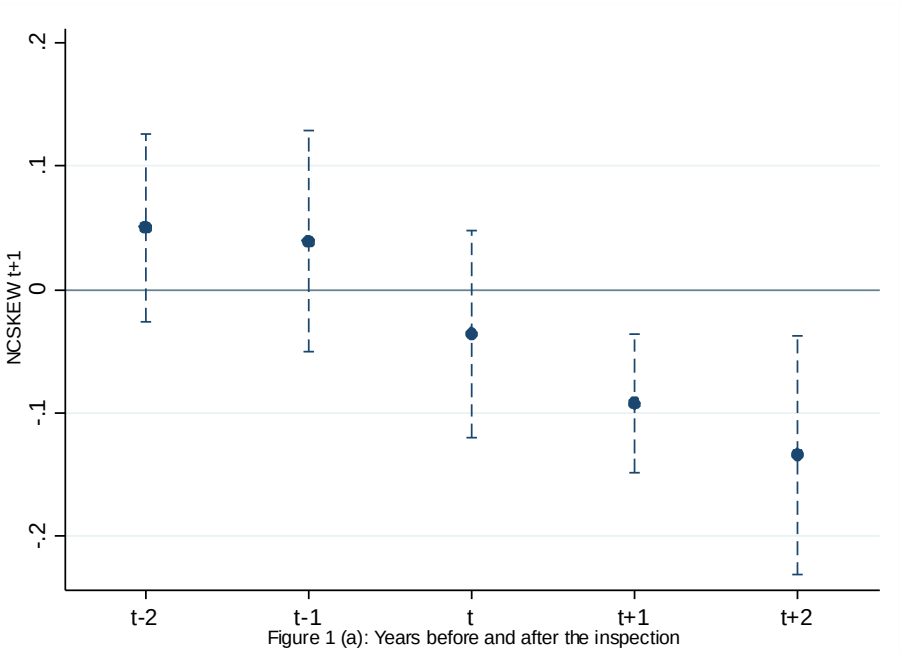

Figure 1 (a): Years before and after the inspection

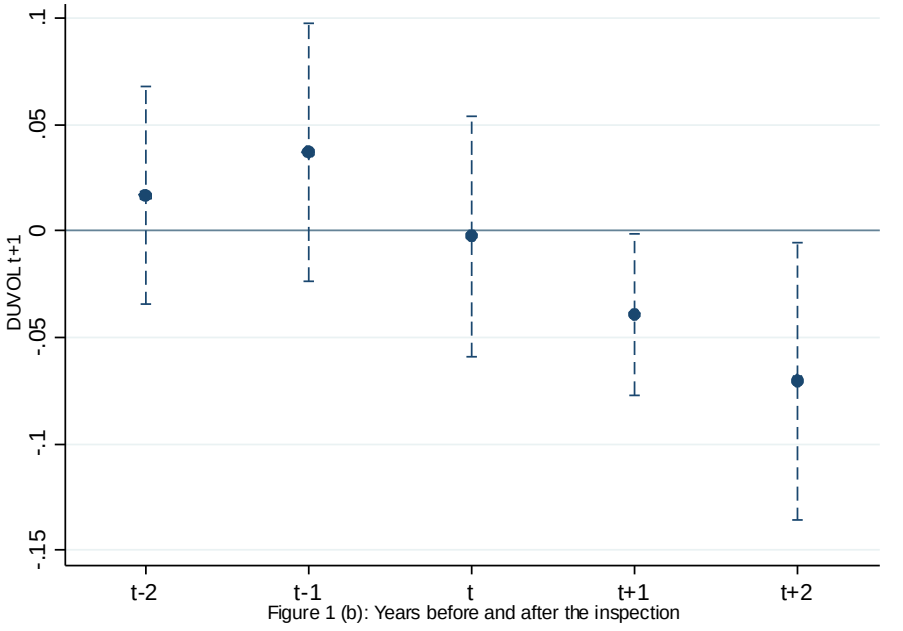

Figure 1 (b): Years before and after the inspection

Table 1. The implementation time of the environmental inspection

Table 1 presents the implementation time of the environmental inspection in each province or municipality. The inspection time is obtained from the Ministry of Ecology and Environment of People's Republic of China (http://www.mee.gov.cn).

Inspection time	Provinces or municipalities
Jan. – Feb. 2016	Hebei
July - Aug. 2016	Ningxia, Jiangxi, Guangxi, Inner Mongolia, Jiangsu, Yunnan, Henan, and Heilongjiang
Nov. – Dec. 2016	Chongqing, Hubei, Shanghai, Guangdong, Shaanxi, Beijing, and Gansu
Apr. - May 2017	Anhui, Fujian, Hunan, Tianjin, Shanxi, Guizhou, and Liaoning
Aug. - Sept. 2017	Shandong, Zhejiang, Qinghai, Xinjiang, Sichuan, Xizang, Jilin, and Hainan

Table 2. Summary statistics

Table 2 presents the summary statistics of main variables used in this study. The sample includes 5,710 firm-year observations from 2014 to 2018. The detailed variable definition of each variable is presented in Appendix B.

Variable	Obs	Mean	Std.Dev.	Min	Max
Inspection	5,710	0.482	0.500	0.000	1.000
PC	5,710	0.316	0.465	0.000	1.000
Achieved PC	5,710	0.191	0.393	0.000	1.000
Ascribed PC	5,710	0.101	0.302	0.000	1.000
$NCSKEW_{t+1}$	5,710	-0.288	0.694	-2.460	1.678
$DUVOL_{t+1}$	5,710	-0.200	0.468	-1.409	1.006
NCSKEW	5,710	-0.276	0.698	-2.398	1.706
DUVOL	5,710	-0.197	0.484	-1.366	1.042
Dturn	5,710	-0.023	0.225	-0.632	0.676
RET	5,710	-0.124	0.112	-0.611	-0.013
Sigma	5,710	0.046	0.019	0.016	0.111
BM ratio	5,710	0.318	0.138	0.069	0.742
ABACC	5,710	0.069	0.075	0.001	0.470
ROA	5,710	0.049	0.051	-0.243	0.195
Firm size	5,710	22.730	1.264	19.679	26.100
Leverage	5,710	0.435	0.196	0.054	0.926
State Ownership	5,710	0.194	0.244	0.000	0.785
Largest	5,710	0.352	0.150	0.090	0.756

Table 3. Correlation matrix

Table 3 reports the correlation matrix of main variables used in regression analysis. *** indicates significance at the 1% level.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
(1) PC	1								
(2) Achieved PC	0.714***	1							
(3) Ascribed PC	0.494***	-0.111***	1						
(4) NCSKEW $_{t+1}$	-0.020	-0.024	-0.001	1					
(5) DUVOL $_{t+1}$	-0.018	-0.034***	0.018	0.871***	1				
(6) Inspection	-0.047***	-0.059***	0.007	0.049***	0.060***	1			
(7) NCSKEW	-0.029	-0.031	-0.008	0.030	0.030	0.168***	1		
(8) DUVOL	-0.023	-0.035***	0.005	0.033	0.036***	0.187***	0.882***	1	
(9) Dturn	0.007	0.014	-0.015	-0.109***	-0.130***	-0.225***	-0.009	-0.020	1
(10) RET	0.048***	-0.010	0.073***	0.070***	0.096***	0.326***	0.110***	0.111***	-0.482***
(11) Sigma	-0.059***	0.006	-0.085***	-0.070***	-0.096***	-0.342***	-0.091***	-0.096***	0.507***
(12) BM ratio	0.027	-0.002	0.052***	-0.033	-0.016	0.292***	0.074***	0.085***	-0.148***
(13) ABACC	0.006	0.009	0.003	0.015	0.015	-0.057***	-0.019	-0.021	-0.051***
(14) ROA	0.001	0.007	-0.016	0.089***	0.075***	-0.010	0.024	0.012	-0.039***
(15) Firm Size	0.057***	-0.043***	0.130***	0.008	0.016	0.123***	-0.007	-0.011	-0.013
(16) Leverage	0.020	-0.021	0.053***	-0.037***	-0.026	0.025	-0.030	-0.026	0.021
(17) State Ownership	-0.068***	-0.239***	0.182***	-0.016	-0.007	-0.005	-0.033	-0.028	0.024
(18) Largest	-0.018	-0.056***	0.050***	-0.001	-0.010	-0.073***	-0.017	-0.022	0.027

Table 3 (continued)

	(10)	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	*(18)*
(10) RET	1								
(11) Sigma	-0.972***	1							
(12) BM ratio	0.337***	-0.361***	1						
(13) ABACC	-0.075***	0.080***	-0.095***	1					
(14) ROA	0.081***	-0.079***	-0.023	-0.026	1				
(15) Firm Size	0.214***	-0.234***	0.069***	-0.042***	-0.134***	1			
(16) Leverage	-0.003	0.004	-0.373***	0.037***	-0.415***	0.597***	1		
(17) State Ownership	0.106***	-0.122***	0.068***	-0.073***	-0.104***	0.468***	0.276***	1	

(18) Largest	0.026	-0.033	-0.003	-0.026	0.066***	0.241***	0.117***	0.428***	1

Table 4. Baseline regressions

This table presents the baseline regression results. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

Variables	(1) $NCSKEW_{t+1}$	(2) $DUVOL_{t+1}$	(3) $NCSKEW_{t+1}$	(4) $DUVOL_{t+1}$
*Inspection * PC*	0.100**	0.080***	0.099**	0.080***
	(2.554)	(3.064)	(2.551)	(3.053)
PC	-0.084***	-0.059***	-0.082***	-0.058***
	(-3.107)	(-3.277)	(-3.057)	(-3.218)
Inspection	-0.086	-0.052	-0.087	-0.054
	(-1.545)	(-1.410)	(-1.576)	(-1.441)
NCSKEW			0.037***	
			(2.799)	
DUVOL				0.035***
				(2.726)
Dturn			-0.087	-0.053
			(-1.559)	(-1.415)
RET			0.200	0.303
			(0.569)	(1.282)
Sigma			3.191	2.544*
			(1.496)	(1.772)
BM ratio			-0.404***	-0.199***
			(-4.299)	(-3.149)
ABACC			0.086	0.047
			(0.700)	(0.565)
ROA			0.748***	0.485***
			(3.477)	(3.348)
Firm size			0.049***	0.024***
			(4.294)	(3.042)
Leverage			-0.274***	-0.123**
			(-3.241)	(-2.150)
State Ownership			-0.045	-0.016
			(-0.908)	(-0.477)
Largest			-0.031	-0.053
			(-0.448)	(-1.157)
Constant	-0.075	-0.087	-1.084***	-0.582***
	(-0.876)	(-1.504)	(-4.217)	(-3.364)
Observations	5,710	5,710	5,710	5,710
Adjusted R-squared	0.046	0.052	0.058	0.059
Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 5. Political connections by type

Table 5 reports the main regression results concerning two types of political connections, achieved political connection and ascribed political connection. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	(1)	(2)	(3)	(4)
Variables	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$
*Inspection * Achieved PC*	0.125***	0.096***	0.120***	0.093***
	(2.685)	(3.080)	(2.594)	(2.986)
*Inspection * Ascribed PC*	0.014	0.003	0.032	0.013
	(0.235)	(0.075)	(0.531)	(0.316)
Achieved PC	-0.098***	-0.077***	-0.098***	-0.077***
	(-3.137)	(-3.678)	(-3.082)	(-3.592)
Ascribed PC	-0.033	0.005	-0.034	0.004
	(-0.773)	(0.184)	(-0.792)	(0.144)
Inspection	-0.080	-0.046	-0.082	-0.048
	(-1.440)	(-1.240)	(-1.488)	(-1.284)
NCSKEW			0.037***	
			(2.798)	
DUVOL				0.035***
				(2.703)
Dturn			-0.086	-0.053
			(-1.554)	(-1.412)
RET			0.179	0.282
			(0.510)	(1.191)
Sigma			3.092	2.441*
			(1.448)	(1.699)
BM ratio			-0.402***	-0.198***
			(-4.274)	(-3.132)
ABACC			0.087	0.046
			(0.708)	(0.555)
ROA			0.746***	0.481***
			(3.465)	(3.320)
Firm size			0.049***	0.023***
			(4.246)	(3.005)
Leverage			-0.274***	-0.122**
			(-3.230)	(-2.134)
State Ownership			-0.052	-0.028
			(-1.020)	(-0.812)
Largest			-0.027	-0.048
			(-0.388)	(-1.034)
Constant	-0.084	-0.094	-1.082***	-0.583***
	(-0.979)	(-1.633)	(-4.197)	(-3.360)
Observations	5,710	5,710	5,710	5,710
Adjusted R-squared	0.046	0.052	0.058	0.059
Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 6. Robustness checks: using office address and firm-fixed effects

Table 6 reports the robustness checks on the main regression results. Panel A refers to the regression analysis where inspection effect is identified based on firms' office address. Panel B reports regression results controlling for multiple fixed effects. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

Panel A: Office address

Variables	(1) $NCSKEW_{t+1}$	(2) $NCSKEW_{t+1}$	(3) $DUVOL_{t+1}$	(4) $DUVOL_{t+1}$
*Inspection Office * PC*	0.098**		0.082***	
	(2.525)		(3.125)	
*Inspection Office * Achieved PC*		0.119**		0.096***
		(2.560)		(3.058)
*Inspection Office * Ascribed PC*		0.033		0.014
		(0.544)		(0.339)
PC	-0.082***		-0.059***	
	(-3.042)		(-3.268)	
Achieved PC		-0.097***		-0.077***
		(-3.063)		(-3.640)
Ascribed PC		-0.034		0.004
		(-0.800)		(0.129)
Inspection Office	-0.096*	-0.091*	-0.060	-0.054
	(-1.743)	(-1.657)	(-1.605)	(-1.451)
NCSKEW	0.037***	0.037***		
	(2.793)	(2.793)		
DUVOL			0.035***	0.035***
			(2.720)	(2.699)
Dturn	-0.086	-0.086	-0.053	-0.053
	(-1.556)	(-1.551)	(-1.410)	(-1.407)
RET	0.199	0.179	0.303	0.281
	(0.567)	(0.508)	(1.282)	(1.188)
Sigma	3.186	3.087	2.543*	2.435*
	(1.494)	(1.445)	(1.772)	(1.695)
BM ratio	-0.405***	-0.403***	-0.200***	-0.199***
	(-4.310)	(-4.286)	(-3.158)	(-3.142)
ABACC	0.087	0.087	0.047	0.046
	(0.711)	(0.714)	(0.577)	(0.562)
ROA	0.748***	0.746***	0.486***	0.481***
	(3.479)	(3.463)	(3.352)	(3.320)
Firm size	0.049***	0.049***	0.024***	0.023***
	(4.296)	(4.252)	(3.047)	(3.010)
Leverage	-0.275***	-0.274***	-0.123**	-0.122**
	(-3.247)	(-3.239)	(-2.154)	(-2.139)
State Ownership	-0.045	-0.052	-0.016	-0.028
	(-0.912)	(-1.026)	(-0.482)	(-0.817)
Largest	-0.030	-0.026	-0.053	-0.047
	(-0.445)	(-0.385)	(-1.155)	(-1.030)
Constant	-1.085***	-1.083***	-0.583***	-0.583***
	(-4.219)	(-4.202)	(-3.365)	(-3.362)

Observations	5,710	5,710	5,710	5,710
Adjusted R-squared	0.058	0.058	0.059	0.059
Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Panel B: Firm-fixed effects

	(1)	(2)	(3)	(4)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.093**		0.083***	
	(2.286)		(3.046)	
*Inspection * Achieved PC*		0.095*		0.089***
		(1.939)		(2.703)
*Inspection * Ascribed PC*		0.052		0.027
		(0.825)		(0.630)
PC	-0.042		-0.031	
	(-1.041)		(-1.119)	
Achieved PC		-0.003		-0.040
		(-0.062)		(-1.214)
Ascribed PC		-0.076		0.018
		(-1.265)		(0.442)
Inspection	-0.094*	-0.089	-0.049	-0.042
	(-1.737)	(-1.636)	(-1.329)	(-1.161)
NCSKEW	-0.182***	-0.181***		
	(-12.160)	(-12.132)		
DUVOL			-0.195***	-0.194***
			(-13.410)	(-13.389)
Dturn	-0.118**	-0.116**	-0.066*	-0.065*
	(-2.027)	(-2.003)	(-1.691)	(-1.664)
RET	-0.140	-0.150	-0.138	-0.151
	(-0.353)	(-0.377)	(-0.518)	(-0.568)
Sigma	1.325	1.245	-0.205	-0.289
	(0.530)	(0.497)	(-0.122)	(-0.172)
BM ratio	-1.117***	-1.120***	-0.759***	-0.759***
	(-7.069)	(-7.082)	(-7.161)	(-7.150)
ABACC	0.076	0.081	0.066	0.066
	(0.548)	(0.586)	(0.716)	(0.707)
ROA	0.134	0.125	0.091	0.093
	(0.460)	(0.429)	(0.465)	(0.474)
Firm size	0.193***	0.193***	0.107***	0.104***
	(4.532)	(4.514)	(3.747)	(3.613)
Leverage	-0.734***	-0.739***	-0.520***	-0.524***
	(-4.314)	(-4.345)	(-4.556)	(-4.588)
State Ownership	0.308	0.293	0.238	0.230
	(1.043)	(0.990)	(1.202)	(1.162)
Largest	-0.202	-0.200	-0.229	-0.223
	(-0.848)	(-0.836)	(-1.431)	(-1.391)
Constant	-4.033***	-4.043***	-2.012***	-1.954***
	(-4.042)	(-4.040)	(-3.005)	(-2.909)

Observations	5,710	5,710	5,710	5,710
Adjusted R-squared	0.126	0.125	0.133	0.132
Province-fixed effects	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 7. Robustness checks: Excluding re-visit year

Table 7 presents the results of robustness check after removing observations from 2018 when some provinces were re-visited. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

Variables	(1) $NCSKEW_{t+1}$	(2) $NCSKEW_{t+1}$	(3) $DUVOL_{t+1}$	(4) $DUVOL_{t+1}$
*Inspection * PC*	0.087*		0.082**	
	(1.878)		(2.523)	
*Inspection * Achieved PC*		0.115**		0.097**
		(2.050)		(2.491)
*Inspection * Ascribed PC*		-0.022		-0.013
		(-0.309)		(-0.259)
PC	-0.079***		-0.054***	
	(-2.924)		(-2.902)	
Achieved PC		-0.099***		-0.075***
		(-3.125)		(-3.413)
Ascribed PC		-0.018		0.014
		(-0.423)		(0.472)
Inspection	-0.089	-0.081	-0.060	-0.052
	(-1.560)	(-1.433)	(-1.509)	(-1.310)
NCSKEW	0.046***	0.046***		
	(3.012)	(3.011)		
DUVOL			0.049***	0.048***
			(3.228)	(3.200)
Dturn	-0.149**	-0.148**	-0.090**	-0.090**
	(-2.455)	(-2.437)	(-2.144)	(-2.124)
RET	0.168	0.137	0.364	0.336
	(0.442)	(0.360)	(1.380)	(1.271)
Sigma	3.123	2.952	3.112*	2.956*
	(1.309)	(1.237)	(1.879)	(1.784)
BM ratio	-0.303***	-0.298***	-0.169**	-0.165**
	(-2.641)	(-2.595)	(-2.119)	(-2.073)
ABACC	0.059	0.061	0.014	0.014
	(0.442)	(0.459)	(0.148)	(0.152)
ROA	0.914***	0.908***	0.648***	0.640***
	(3.371)	(3.344)	(3.442)	(3.399)
Firm size	0.031**	0.030**	0.016*	0.015*
	(2.334)	(2.265)	(1.726)	(1.657)
Leverage	-0.103	-0.101	-0.029	-0.027
	(-1.074)	(-1.048)	(-0.440)	(-0.401)
State Ownership	-0.039	-0.051	-0.008	-0.024
	(-0.690)	(-0.876)	(-0.214)	(-0.594)
Largest	-0.039	-0.033	-0.051	-0.044
	(-0.508)	(-0.430)	(-0.967)	(-0.836)
Constant	-0.759***	-0.749**	-0.449**	-0.442**
	(-2.582)	(-2.539)	(-2.198)	(-2.159)
Observations	4,427	4,427	4,427	4,427
Adjusted R-squared	0.059	0.059	0.062	0.062

Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 8. Robustness checks: Placebo test

Table 8 presents the placebo test results using the pseudo inspection-year. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	(1)	(2)	(3)	(4)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Pseudo Inspection * PC*	0.038		0.024	
	(1.229)		(1.141)	
*Pseudo Inspection * Achieved PC*		0.064		0.047
		(1.705)		(1.874)
*Pseudo Inspection * Ascribed PC*		0.012		-0.009
		(0.242)		(-0.297)
PC	-0.031		-0.014	
	(-1.298)		(-0.902)	
Achieved PC		-0.050		-0.041*
		(-1.765)		(-2.149)
Ascribed PC		-0.010		0.024
		(-0.279)		(0.986)
Pseudo Inspection	-0.013	-0.014	-0.007	-0.007
	(-0.491)	(-0.505)	(-0.367)	(-0.384)
Controls and constant	Yes	Yes	Yes	Yes
Simulation times	1,000	1,000	1,000	1,000
Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 9. Robustness checks: PSM analysis

Table 9 reports the regression results using the PSM analysis. Panel A refers to the balance test of the PSM analysis. Panel B presents the regression results using the PSM sample. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

Panel A: The balance test of PSM analysis

	Unmatched (U)	Mean			% reduct	t-test	
Variable	Matched (M)	Treated	Control	%bias	|bias|	t	p>|t|
Dturn	U	-0.076	0.026	-46.6		-17.47	0
	M	-0.050	-0.050	-0.3	99.4	-0.09	0.93
RET	U	-0.086	-0.159	69.8		26.06	0
	M	-0.101	-0.102	1.1	98.5	0.44	0.658
Sigma	U	0.040	0.053	-73.3		-27.46	0
	M	0.043	0.043	-0.8	98.9	-0.29	0.773
BM ratio	U	0.360	0.279	60.8		23.04	0
	M	0.312	0.318	-4.9	91.9	-1.59	0.112
ABACC	U	0.065	0.074	-11.5		-4.35	0
	M	0.070	0.071	-1.9	83.7	-0.55	0.579
ROA	U	0.048	0.049	-2		-0.76	0.445
	M	0.049	0.050	-2	-1	-0.57	0.571
Firm Size	U	22.891	22.581	24.8		9.34	0
	M	22.857	22.809	3.9	84.2	1.13	0.261
Leverage	U	0.440	0.431	5		1.89	0.059
	M	0.450	0.443	3.5	30.2	1.03	0.305
State Ownership	U	0.193	0.196	-1.1		-0.41	0.684
	M	0.207	0.203	1.5	-42.9	0.45	0.654
Largest	U	0.340	0.362	-14.6		-5.52	0
	M	0.358	0.357	0.6	95.9	0.18	0.858

Panel B: PSM analysis				
Variables	(1) $NCSKEW_{t+1}$	(2) $NCSKEW_{t+1}$	(3) $DUVOL_{t+1}$	(4) $DUVOL_{t+1}$
*Inspection * PC*	0.085*		0.075**	
	(1.772)		(2.249)	
*Inspection * Achieved PC*		0.123**		0.104***
		(2.134)		(2.593)
*Inspection * Ascribed PC*		-0.025		-0.013
		(-0.341)		(-0.249)
PC	-0.081**		-0.058**	
	(-2.393)		(-2.468)	
Achieved PC		-0.082**		-0.070**
		(-2.058)		(-2.531)
Ascribed PC		-0.050		-0.010
		(-0.939)		(-0.279)
Inspection	-0.086	-0.080	-0.051	-0.046
	(-1.206)	(-1.125)	(-1.039)	(-0.937)
NCSKEW	0.058***	0.059***		
	(3.424)	(3.450)		
DUVOL			0.061***	0.061***
			(3.616)	(3.620)
Dturn	-0.078	-0.074	-0.052	-0.049
	(-1.084)	(-1.030)	(-1.044)	(-0.990)
RET	1.162*	1.168*	0.646	0.641
	(1.779)	(1.787)	(1.433)	(1.420)
Sigma	7.080**	7.039**	3.568	3.487
	(2.090)	(2.076)	(1.524)	(1.488)
BM ratio	-0.330**	-0.325**	-0.173*	-0.172*
	(-2.565)	(-2.528)	(-1.944)	(-1.929)
ABACC	0.134	0.141	0.080	0.083
	(0.876)	(0.923)	(0.755)	(0.784)
ROA	0.899***	0.900***	0.545***	0.544***
	(3.444)	(3.446)	(3.016)	(3.011)
Firm size	0.058***	0.057***	0.030***	0.029***
	(4.143)	(3.999)	(3.078)	(2.959)
Leverage	-0.355***	-0.351***	-0.179**	-0.176**
	(-3.256)	(-3.216)	(-2.370)	(-2.325)
State Ownership	-0.079	-0.068	-0.033	-0.033
	(-1.279)	(-1.075)	(-0.772)	(-0.762)
Largest	-0.009	-0.015	-0.034	-0.036
	(-0.103)	(-0.178)	(-0.575)	(-0.598)
Constant	-1.330***	-1.295***	-0.738***	-0.718***
	(-4.165)	(-4.047)	(-3.337)	(-3.243)
Observations	3,488	3,488	3,488	3,488
Adjusted R-squared	0.060	0.060	0.055	0.055
Province-fixed effects	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 10. Regional environmental governance

Table 10 presents the subsample analysis regarding the enforcement of regional environmental governance that is measured by the regional investment of industrial pollution control. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	Strong Environmental Governance				Weak Environmental Governance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.071		0.041		0.118**		0.106***	
	(1.101)		(0.970)		(2.406)		(3.153)	
*Inspection * Achieved PC*		0.091		0.056		0.143**		0.117***
		(1.212)		(1.124)		(2.376)		(2.856)
*Inspection * Ascribed PC*		-0.026		-0.067		0.064		0.066
		(-0.248)		(-0.974)		(0.864)		(1.306)
PC	-0.098**		-0.073**		-0.071**		-0.047**	
	(-2.107)		(-2.399)		(-2.135)		(-2.091)	
Achieved PC		-0.115**		-0.089**		-0.086**		-0.068**
		(-2.125)		(-2.501)		(-2.189)		(-2.547)
Ascribed PC		-0.020		0.007		-0.039		0.003
		(-0.261)		(0.144)		(-0.748)		(0.096)
Inspection	0.060	0.066	0.012	0.020	-0.141*	-0.138*	-0.075	-0.072
	(0.512)	(0.568)	(0.159)	(0.264)	(-1.952)	(-1.919)	(-1.530)	(-1.466)
NCSKEW	0.030	0.029			0.045***	0.045***		
	(1.349)	(1.312)			(2.677)	(2.713)		
DUVOL			0.019	0.019			0.046***	0.047***
			(0.923)	(0.893)			(2.801)	(2.818)
Dturn	-0.150	-0.150	-0.116*	-0.116*	-0.058	-0.057	-0.015	-0.014
	(-1.625)	(-1.625)	(-1.915)	(-1.919)	(-0.812)	(-0.808)	(-0.302)	(-0.293)
RET	0.538	0.522	0.456	0.438	0.044	0.019	0.229	0.206
	(0.894)	(0.867)	(1.149)	(1.103)	(0.100)	(0.043)	(0.770)	(0.693)
Sigma	5.897*	5.829	4.061*	3.969*	1.892	1.763	1.753	1.649
	(1.665)	(1.644)	(1.739)	(1.699)	(0.700)	(0.651)	(0.952)	(0.894)
BM ratio	-0.376**	-0.372**	-0.160	-0.157	-0.424***	-0.425***	-0.225***	-0.229***

	(-2.440)	(-2.412)	(-1.574)	(-1.544)	(-3.539)	(-3.540)	(-2.754)	(-2.798)
ABACC	-0.037	-0.033	-0.027	-0.021	0.192	0.192	0.113	0.109
	(-0.183)	(-0.164)	(-0.204)	(-0.162)	(1.232)	(1.233)	(1.066)	(1.029)
ROA	0.912**	0.895**	0.579**	0.562**	0.628**	0.635**	0.401**	0.407**
	(2.566)	(2.516)	(2.472)	(2.396)	(2.285)	(2.311)	(2.143)	(2.174)
Firm size	0.062***	0.062***	0.035***	0.035***	0.044***	0.043***	0.017*	0.017*
	(3.202)	(3.210)	(2.740)	(2.760)	(3.027)	(3.009)	(1.730)	(1.768)
Leverage	-0.336**	-0.337**	-0.176*	-0.176*	-0.248**	-0.248**	-0.099	-0.100
	(-2.285)	(-2.288)	(-1.812)	(-1.814)	(-2.384)	(-2.385)	(-1.399)	(-1.409)
State Ownership	-0.131	-0.141	-0.082	-0.093	-0.001	-0.006	0.022	0.009
	(-1.559)	(-1.633)	(-1.487)	(-1.636)	(-0.020)	(-0.095)	(0.518)	(0.201)
Largest	0.038	0.043	-0.067	-0.060	-0.060	-0.058	-0.038	-0.032
	(0.325)	(0.371)	(-0.866)	(-0.781)	(-0.713)	(-0.680)	(-0.658)	(-0.561)
Constant	-1.479***	-1.501***	-0.896***	-0.915***	-0.833**	-0.828**	-0.344	-0.353
	(-3.499)	(-3.543)	(-3.216)	(-3.279)	(-2.497)	(-2.476)	(-1.513)	(-1.549)
Observations	2,174	2,174	2,174	2,174	3,536	3,536	3,536	3,536
Adjusted R-squared	0.055	0.054	0.057	0.057	0.058	0.058	0.061	0.061
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11. Environmental misconduct cases

Table 11 presents the subsample analysis regarding the number of environmental misconduct cases in each province that are identified by the inspection team. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	More Misconduct Cases				Fewer Misconduct Cases			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.105**		0.081***		0.066		0.079	
	(2.388)		(2.744)		(0.789)		(1.379)	
*Inspection * Achieved PC*		0.103**		0.075**		0.164		0.162**
		(1.973)		(2.152)		(1.602)		(2.313)
*Inspection * Ascribed PC*		0.052		0.026		-0.026		-0.019
		(0.757)		(0.562)		(-0.209)		(-0.227)
PC	-0.078**		-0.049**		-0.069		-0.080*	
	(-2.576)		(-2.432)		(-1.161)		(-1.961)	
Achieved PC		-0.091**		-0.063***		-0.096		-0.116**
		(-2.560)		(-2.668)		(-1.337)		(-2.355)
Ascribed PC		-0.026		0.011		-0.037		-0.013
		(-0.525)		(0.341)		(-0.413)		(-0.202)
Inspection	-0.054	-0.046	-0.030	-0.022	-0.195	-0.197*	-0.137*	-0.137*
	(-0.861)	(-0.738)	(-0.712)	(-0.525)	(-1.635)	(-1.660)	(-1.674)	(-1.677)
NCSKEW	0.045***	0.045***			0.006	0.005		
	(3.009)	(3.015)			(0.189)	(0.177)		
DUVOL			0.035**	0.035**			0.032	0.032
			(2.428)	(2.410)			(1.122)	(1.120)
Dturn	-0.098	-0.098	-0.049	-0.049	-0.032	-0.031	-0.067	-0.067
	(-1.562)	(-1.563)	(-1.162)	(-1.158)	(-0.263)	(-0.258)	(-0.799)	(-0.806)
RET	0.226	0.206	0.387	0.367	0.237	0.219	0.007	-0.018
	(0.562)	(0.512)	(1.442)	(1.364)	(0.321)	(0.296)	(0.013)	(-0.035)
Sigma	3.437	3.357	3.009*	2.917*	3.158	3.079	1.042	0.948
	(1.410)	(1.375)	(1.844)	(1.785)	(0.705)	(0.687)	(0.339)	(0.309)
BM ratio	-0.448***	-0.445***	-0.216***	-0.214***	-0.284	-0.278	-0.189	-0.187

	(-4.162)	(-4.129)	(-3.002)	(-2.971)	(-1.432)	(-1.399)	(-1.383)	(-1.371)
ABACC	0.078	0.077	0.044	0.042	0.114	0.106	0.045	0.038
	(0.569)	(0.560)	(0.480)	(0.458)	(0.421)	(0.393)	(0.243)	(0.206)
ROA	0.770***	0.770***	0.414**	0.415**	0.510	0.547	0.706**	0.721**
	(3.159)	(3.158)	(2.539)	(2.542)	(1.084)	(1.160)	(2.191)	(2.232)
Firm size	0.054***	0.054***	0.028***	0.028***	0.036	0.035	0.014	0.013
	(4.107)	(4.107)	(3.149)	(3.161)	(1.483)	(1.424)	(0.817)	(0.747)
Leverage	-0.348***	-0.347***	-0.182***	-0.180***	-0.052	-0.048	0.044	0.046
	(-3.577)	(-3.559)	(-2.785)	(-2.753)	(-0.298)	(-0.271)	(0.367)	(0.381)
State Ownership	-0.035	-0.048	-0.017	-0.033	-0.048	-0.041	-0.002	-0.003
	(-0.606)	(-0.819)	(-0.441)	(-0.840)	(-0.444)	(-0.376)	(-0.029)	(-0.043)
Largest	-0.033	-0.026	-0.067	-0.060	-0.049	-0.050	-0.015	-0.016
	(-0.421)	(-0.336)	(-1.288)	(-1.147)	(-0.325)	(-0.333)	(-0.150)	(-0.152)
Constant	-1.166***	-1.179***	-0.643***	-0.655***	-0.791	-0.778	-0.515	-0.502
	(-3.986)	(-4.017)	(-3.282)	(-3.332)	(-1.385)	(-1.361)	(-1.315)	(-1.280)
Observations	4,470	4,470	4,470	4,470	1,240	1,240	1,240	1,240
Adjusted R-squared	0.064	0.064	0.065	0.065	0.028	0.028	0.030	0.031
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 12. SOE and non-SOE

Table 12 presents the subsample analysis using SOEs and non-SOEs subsamples. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	Non-SOEs				SOEs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.092*		0.061*		0.106*		0.109**	
	(1.865)		(1.857)		(1.663)		(2.494)	
*Inspection * Achieved PC*		0.090*		0.051		0.189*		0.224***
		(1.691)		(1.446)		(1.656)		(2.874)
*Inspection * Ascribed PC*		-0.012		0.005		0.092		0.055
		(-0.113)		(0.069)		(1.221)		(1.073)
PC	-0.076**		-0.049**		-0.094**		-0.077**	
	(-2.189)		(-2.127)		(-2.108)		(-2.520)	
Achieved PC		-0.074**		-0.050**		-0.178**		-0.165***
		(-2.023)		(-2.054)		(-2.430)		(-3.293)
Ascribed PC		-0.003		0.013		-0.071		-0.026
		(-0.039)		(0.264)		(-1.321)		(-0.708)
Inspection	-0.119*	-0.111	-0.064	-0.057	-0.027	-0.027	-0.036	-0.030
	(-1.696)	(-1.582)	(-1.371)	(-1.225)	(-0.303)	(-0.305)	(-0.587)	(-0.493)
NCSKEW	0.035**	0.035**			0.040*	0.040*		
	(2.045)	(2.046)			(1.825)	(1.814)		
DUVOL			0.027	0.027			0.046**	0.046**
			(1.643)	(1.635)			(2.180)	(2.150)
Dturn	-0.097	-0.098	-0.050	-0.051	-0.036	-0.032	-0.047	-0.041
	(-1.378)	(-1.384)	(-1.059)	(-1.081)	(-0.379)	(-0.343)	(-0.731)	(-0.640)
RET	-0.164	-0.160	-0.049	-0.050	0.789	0.750	0.899**	0.838**
	(-0.365)	(-0.358)	(-0.166)	(-0.169)	(1.278)	(1.213)	(2.131)	(1.984)
Sigma	1.201	1.255	0.335	0.369	6.504*	6.288*	6.338***	5.923**
	(0.430)	(0.449)	(0.180)	(0.198)	(1.847)	(1.779)	(2.635)	(2.455)
BM ratio	-0.460***	-0.458***	-0.248***	-0.246***	-0.389**	-0.393**	-0.166	-0.169
	(-3.773)	(-3.752)	(-3.048)	(-3.027)	(-2.479)	(-2.500)	(-1.548)	(-1.578)

ABACC	0.112	0.109	0.094	0.088	0.083	0.089	-0.015	-0.008
	(0.742)	(0.721)	(0.930)	(0.874)	(0.383)	(0.410)	(-0.102)	(-0.054)
ROA	0.643**	0.640**	0.422**	0.417**	0.955**	0.950**	0.589**	0.577**
	(2.478)	(2.466)	(2.444)	(2.412)	(2.323)	(2.307)	(2.096)	(2.053)
Firm size	0.059***	0.058***	0.032***	0.032***	0.049***	0.050***	0.025**	0.024**
	(3.591)	(3.556)	(2.887)	(2.885)	(2.818)	(2.843)	(2.061)	(2.026)
Leverage	-0.262**	-0.262**	-0.135*	-0.136*	-0.305**	-0.311**	-0.142	-0.143
	(-2.390)	(-2.393)	(-1.846)	(-1.862)	(-2.085)	(-2.124)	(-1.420)	(-1.431)
State Ownership	-0.150	-0.156	-0.058	-0.068	0.218	0.214	0.029	0.028
	(-0.714)	(-0.739)	(-0.414)	(-0.485)	(1.512)	(1.481)	(0.290)	(0.281)
Largest	-0.034	-0.032	-0.056	-0.054	-0.144	-0.149	-0.032	-0.036
	(-0.391)	(-0.373)	(-0.959)	(-0.937)	(-0.953)	(-0.984)	(-0.310)	(-0.350)
Constant	-1.230***	-1.232***	-0.699***	-0.709***	-1.351***	-1.347***	-0.765**	-0.744**
	(-3.457)	(-3.458)	(-2.946)	(-2.984)	(-3.109)	(-3.097)	(-2.573)	(-2.500)
Observations	3,571	3,571	3,571	3,571	2,139	2,139	2,139	2,139
Adjusted R-squared	0.062	0.061	0.066	0.065	0.044	0.044	0.048	0.049
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 13. Information asymmetry

Table 13 presents the subsample analysis regarding information asymmetry that is measured by analyst forecast accuracy. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	Low Information Asymmetry				High Information Asymmetry			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.040		0.045		0.161***		0.120***	
	(0.747)		(1.223)		(2.849)		(3.200)	
*Inspection * Achieved PC*		-0.001		0.006		0.237***		0.180***
		(-0.021)		(0.126)		(3.593)		(4.094)
*Inspection * Ascribed PC*		0.016		0.001		0.052		0.030
		(0.197)		(0.019)		(0.581)		(0.497)
PC	-0.051		-0.032		-0.113***		-0.085***	
	(-1.380)		(-1.270)		(-2.854)		(-3.228)	
Achieved PC		-0.042		-0.025		-0.160***		-0.132***
		(-0.956)		(-0.828)		(-3.471)		(-4.293)
Ascribed PC		-0.051		-0.004		-0.007		0.020
		(-0.886)		(-0.098)		(-0.113)		(0.446)
Inspection	-0.093	-0.082	-0.018	-0.006	-0.074	-0.072	-0.082	-0.080
	(-1.195)	(-1.057)	(-0.338)	(-0.105)	(-0.944)	(-0.923)	(-1.578)	(-1.548)
NCSKEW	-0.001	-0.001			0.066***	0.066***		
	(-0.039)	(-0.051)			(3.387)	(3.400)		
DUVOL			-0.010	-0.010			0.075***	0.075***
			(-0.545)	(-0.533)			(3.996)	(3.981)
Dturn	-0.083	-0.083	-0.037	-0.036	-0.095	-0.096	-0.074	-0.077
	(-0.984)	(-0.984)	(-0.641)	(-0.626)	(-1.265)	(-1.285)	(-1.492)	(-1.541)
RET	-0.102	-0.120	0.327	0.305	0.537	0.509	0.341	0.316
	(-0.189)	(-0.221)	(0.891)	(0.828)	(1.090)	(1.035)	(1.045)	(0.968)
Sigma	2.067	1.976	2.859	2.748	4.948	4.868	2.909	2.838
	(0.663)	(0.632)	(1.349)	(1.293)	(1.590)	(1.566)	(1.407)	(1.375)
BM ratio	-0.256**	-0.254**	-0.176**	-0.175**	-0.611***	-0.616***	-0.263***	-0.267***

	(-1.992)	(-1.971)	(-2.003)	(-1.994)	(-4.304)	(-4.338)	(-2.787)	(-2.836)
ABACC	-0.034	-0.035	-0.043	-0.046	0.167	0.165	0.120	0.117
	(-0.192)	(-0.200)	(-0.360)	(-0.382)	(0.982)	(0.966)	(1.061)	(1.030)
ROA	0.926***	0.929***	0.505**	0.505**	0.620**	0.623**	0.375*	0.373*
	(2.774)	(2.781)	(2.224)	(2.220)	(2.073)	(2.081)	(1.884)	(1.880)
Firm size	0.041**	0.041**	0.014	0.014	0.060***	0.059***	0.033***	0.033***
	(2.544)	(2.537)	(1.265)	(1.260)	(3.466)	(3.426)	(2.883)	(2.854)
Leverage	-0.084	-0.082	-0.020	-0.018	-0.463***	-0.466***	-0.211***	-0.213***
	(-0.676)	(-0.660)	(-0.234)	(-0.208)	(-3.848)	(-3.874)	(-2.632)	(-2.662)
State Ownership	-0.047	-0.051	-0.012	-0.018	-0.053	-0.072	-0.021	-0.045
	(-0.695)	(-0.736)	(-0.263)	(-0.379)	(-0.701)	(-0.917)	(-0.421)	(-0.871)
Largest	-0.142	-0.141	-0.119*	-0.117*	0.074	0.083	0.012	0.022
	(-1.501)	(-1.492)	(-1.846)	(-1.812)	(0.736)	(0.823)	(0.173)	(0.328)
Constant	-1.048***	-1.052***	-0.443*	-0.448*	-1.160***	-1.154***	-0.728***	-0.726***
	(-2.857)	(-2.858)	(-1.774)	(-1.788)	(-3.116)	(-3.094)	(-2.937)	(-2.930)
Observations	2,923	2,923	2,923	2,923	2,787	2,787	2,787	2,787
Adjusted R-squared	0.059	0.059	0.059	0.058	0.061	0.062	0.064	0.067
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 14. External monitoring

Table 14 presents the subsample analysis regarding external monitoring that is measured by whether a firm is identified as heavy polluter. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	Heavy polluters				Non-heavy polluters			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.045		0.090		0.111**		0.082***	
	(0.457)		(1.356)		(2.517)		(2.752)	
*Inspection * Achieved PC*		0.138		0.154**		0.136**		0.094***
		(1.190)		(1.991)		(2.548)		(2.611)
*Inspection * Ascribed PC*		-0.056		-0.057		0.041		0.022
		(-0.353)		(-0.543)		(0.616)		(0.488)
PC	-0.062		-0.083		-0.087***		-0.056***	
	(-0.729)		(-1.464)		(-3.017)		(-2.917)	
Achieved PC		-0.188*		-0.170**		-0.091***		-0.067***
		(-1.870)		(-2.536)		(-2.687)		(-2.953)
Ascribed PC		0.057		0.061		-0.042		0.000
		(0.420)		(0.675)		(-0.907)		(0.008)
Inspection	-0.062	-0.060	-0.088	-0.078	-0.095	-0.090	-0.050	-0.044
	(-0.472)	(-0.456)	(-0.995)	(-0.890)	(-1.554)	(-1.474)	(-1.217)	(-1.082)
NCSKEW	0.021	0.021			0.039***	0.039***		
	(0.709)	(0.703)			(2.583)	(2.585)		
DUVOL			-0.015	-0.017			0.046***	0.046***
			(-0.544)	(-0.614)			(3.116)	(3.107)
Dturn	0.004	0.007	-0.064	-0.061	-0.108*	-0.107*	-0.057	-0.057
	(0.030)	(0.054)	(-0.740)	(-0.704)	(-1.733)	(-1.725)	(-1.356)	(-1.353)
RET	2.599**	2.477**	1.148	1.038	-0.039	-0.052	0.230	0.217
	(2.415)	(2.297)	(1.600)	(1.444)	(-0.102)	(-0.134)	(0.883)	(0.832)
Sigma	15.328***	14.723***	7.614**	7.038*	1.829	1.780	2.045	1.991
	(2.784)	(2.668)	(2.071)	(1.911)	(0.757)	(0.736)	(1.255)	(1.222)
BM ratio	-0.417**	-0.411**	-0.128	-0.125	-0.402***	-0.400***	-0.214***	-0.213***

	(-2.156)	(-2.127)	(-0.993)	(-0.966)	(-3.698)	(-3.675)	(-2.909)	(-2.899)
ABACC	-0.636*	-0.647*	-0.362	-0.366	0.184	0.187	0.099	0.098
	(-1.896)	(-1.928)	(-1.613)	(-1.632)	(1.390)	(1.405)	(1.110)	(1.099)
ROA	1.530***	1.551***	1.248***	1.264***	0.576**	0.581**	0.337**	0.336**
	(2.946)	(2.987)	(3.591)	(3.640)	(2.378)	(2.394)	(2.062)	(2.054)
Firm size	0.024	0.023	0.016	0.016	0.053***	0.052***	0.024***	0.023***
	(0.933)	(0.908)	(0.963)	(0.936)	(3.991)	(3.894)	(2.655)	(2.591)
Leverage	-0.313	-0.300	-0.110	-0.102	-0.244***	-0.242**	-0.106*	-0.105*
	(-1.494)	(-1.432)	(-0.787)	(-0.728)	(-2.594)	(-2.573)	(-1.679)	(-1.659)
State Ownership	-0.006	-0.044	0.019	-0.011	-0.056	-0.056	-0.027	-0.035
	(-0.056)	(-0.411)	(0.269)	(-0.149)	(-0.971)	(-0.948)	(-0.685)	(-0.883)
Largest	-0.106	-0.104	-0.173*	-0.173*	-0.024	-0.020	-0.032	-0.027
	(-0.715)	(-0.695)	(-1.737)	(-1.735)	(-0.314)	(-0.264)	(-0.620)	(-0.513)
Constant	-0.852	-0.815	-0.612	-0.591	-1.117***	-1.104***	-0.573***	-0.571***
	(-1.413)	(-1.352)	(-1.518)	(-1.466)	(-3.797)	(-3.742)	(-2.886)	(-2.866)
Observations	1,149	1,149	1,149	1,149	4,561	4,561	4,561	4,561
Adjusted R-squared	0.079	0.081	0.070	0.073	0.055	0.054	0.058	0.058
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 15. Sensitivity to local government leader turnovers

Table 15 presents the subsample analysis regarding the sensitivity of firms to the turnover of local government leaders. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	No Official Turnover				Official Turnover			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.092*		0.052		0.101		0.111***	
	(1.800)		(1.515)		(1.626)		(2.652)	
*Inspection * Achieved PC*		0.060		0.037		0.189**		0.161***
		(0.978)		(0.900)		(2.534)		(3.192)
*Inspection * Ascribed PC*		0.056		-0.013		0.017		0.053
		(0.705)		(-0.238)		(0.181)		(0.817)
PC	-0.092***		-0.061***		-0.057		-0.049	
	(-2.755)		(-2.722)		(-1.232)		(-1.572)	
Achieved PC		-0.083**		-0.064**		-0.114**		-0.094**
		(-2.123)		(-2.451)		(-2.059)		(-2.513)
Ascribed PC		-0.042		0.002		-0.032		0.002
		(-0.777)		(0.053)		(-0.438)		(0.047)
Inspection	-0.038	-0.024	-0.068	-0.056	-0.007	-0.010	-0.013	-0.013
	(-0.285)	(-0.180)	(-0.749)	(-0.617)	(-0.089)	(-0.131)	(-0.242)	(-0.241)
NCSKEW	0.034**	0.034**			0.052**	0.052**		
	(1.972)	(1.980)			(2.420)	(2.441)		
DUVOL			0.028*	0.027			0.053***	0.053***
			(1.646)	(1.636)			(2.583)	(2.591)
Dturn	-0.086	-0.089	-0.081	-0.083	-0.080	-0.073	-0.000	0.003
	(-1.126)	(-1.166)	(-1.568)	(-1.606)	(-0.952)	(-0.871)	(-0.002)	(0.060)
RET	0.318	0.313	0.259	0.240	0.007	-0.022	0.472	0.457
	(0.717)	(0.704)	(0.873)	(0.807)	(0.011)	(-0.036)	(1.135)	(1.099)
Sigma	4.159	4.193	2.657	2.577	1.525	1.368	2.591	2.536
	(1.490)	(1.499)	(1.419)	(1.373)	(0.441)	(0.395)	(1.110)	(1.086)
BM ratio	-0.355***	-0.353***	-0.160**	-0.158*	-0.442***	-0.445***	-0.231**	-0.234**
	(-2.940)	(-2.920)	(-1.980)	(-1.947)	(-2.903)	(-2.922)	(-2.245)	(-2.273)

ABACC	-0.035	-0.031	0.010	0.017	0.097	0.101	0.014	0.007
	(-0.205)	(-0.179)	(0.087)	(0.148)	(0.538)	(0.558)	(0.114)	(0.059)
ROA	0.450*	0.446	0.351*	0.346*	1.274***	1.259***	0.711***	0.700***
	(1.650)	(1.631)	(1.913)	(1.883)	(3.507)	(3.466)	(2.901)	(2.854)
Firm size	0.045***	0.045***	0.024**	0.024**	0.054***	0.053***	0.021*	0.020
	(3.024)	(3.036)	(2.400)	(2.398)	(2.925)	(2.886)	(1.670)	(1.637)
Leverage	-0.292***	-0.293***	-0.152**	-0.152**	-0.238*	-0.242*	-0.067	-0.065
	(-2.643)	(-2.650)	(-2.048)	(-2.052)	(-1.774)	(-1.799)	(-0.735)	(-0.720)
State Ownership	-0.041	-0.053	-0.006	-0.020	-0.050	-0.047	-0.033	-0.040
	(-0.643)	(-0.798)	(-0.130)	(-0.437)	(-0.634)	(-0.586)	(-0.616)	(-0.749)
Largest	0.021	0.026	0.001	0.006	-0.118	-0.122	-0.153**	-0.150**
	(0.241)	(0.297)	(0.022)	(0.103)	(-1.100)	(-1.126)	(-2.105)	(-2.055)
Constant	-1.075***	-1.100***	-0.633***	-0.645***	-0.815*	-0.792*	-0.317	-0.310
	(-3.268)	(-3.332)	(-2.867)	(-2.909)	(-1.917)	(-1.861)	(-1.105)	(-1.079)
Observations	3,376	3,376	3,376	3,376	2,334	2,334	2,334	2,334
Adjusted R-squared	0.047	0.046	0.050	0.050	0.054	0.055	0.047	0.048
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 16. Invisible political connections

Table 16 presents the subsample analysis regarding the impact of firms' existing invisible political connections, which is measured by abnormal management expenses (AMEs). *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	Higher AMEs				Lower AMEs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.056		0.039		0.128**		0.109***	
	(1.036)		(1.061)		(2.288)		(2.924)	
*Inspection * Achieved PC*		0.040		0.050		0.195***		0.131***
		(0.623)		(1.137)		(2.924)		(2.931)
*Inspection * Ascribed PC*		0.075		0.015		-0.023		0.002
		(0.888)		(0.255)		(-0.267)		(0.042)
PC	-0.034		-0.029		-0.125***		-0.085***	
	(-0.891)		(-1.121)		(-3.234)		(-3.304)	
Achieved PC		-0.031		-0.047		-0.167***		-0.110***
		(-0.690)		(-1.551)		(-3.697)		(-3.647)
Ascribed PC		-0.049		0.004		-0.002		0.013
		(-0.802)		(0.108)		(-0.036)		(0.324)
Inspection	-0.039	-0.036	-0.007	-0.005	-0.128*	-0.121	-0.090*	-0.081
	(-0.491)	(-0.454)	(-0.128)	(-0.092)	(-1.651)	(-1.574)	(-1.732)	(-1.575)
NCSKEW	0.044**	0.044**			0.023	0.024		
	(2.380)	(2.385)			(1.210)	(1.218)		
DUVOL			0.032*	0.031*			0.031*	0.031*
			(1.756)	(1.726)			(1.684)	(1.683)
Dturn	0.037	0.036	0.026	0.027	-0.205**	-0.208***	-0.123**	-0.127**
	(0.479)	(0.469)	(0.491)	(0.522)	(-2.542)	(-2.590)	(-2.294)	(-2.369)
RET	0.328	0.329	0.166	0.157	-0.121	-0.188	0.323	0.286
	(0.681)	(0.683)	(0.509)	(0.481)	(-0.233)	(-0.361)	(0.935)	(0.825)
Sigma	3.224	3.239	0.942	0.868	2.193	1.941	3.453*	3.343
	(1.096)	(1.100)	(0.473)	(0.435)	(0.701)	(0.619)	(1.652)	(1.597)
BM ratio	-0.319**	-0.320**	-0.099	-0.099	-0.461***	-0.457***	-0.286***	-0.283***

	(-2.383)	(-2.386)	(-1.092)	(-1.087)	(-3.402)	(-3.373)	(-3.157)	(-3.126)
ABACC	0.067	0.067	0.003	0.002	0.108	0.113	0.083	0.082
	(0.375)	(0.370)	(0.025)	(0.016)	(0.641)	(0.674)	(0.741)	(0.732)
ROA	0.886***	0.883***	0.504**	0.501**	0.574*	0.560*	0.482**	0.469**
	(3.008)	(2.997)	(2.524)	(2.510)	(1.800)	(1.754)	(2.259)	(2.199)
Firm size	0.030*	0.031*	0.001	0.001	0.072***	0.070***	0.049***	0.048***
	(1.857)	(1.879)	(0.052)	(0.077)	(4.344)	(4.231)	(4.407)	(4.324)
Leverage	-0.231*	-0.233*	-0.053	-0.053	-0.363***	-0.362***	-0.219***	-0.219***
	(-1.910)	(-1.921)	(-0.645)	(-0.645)	(-2.990)	(-2.990)	(-2.705)	(-2.701)
State Ownership	0.022	0.021	0.036	0.027	-0.095	-0.115	-0.051	-0.071
	(0.301)	(0.282)	(0.736)	(0.546)	(-1.360)	(-1.599)	(-1.098)	(-1.472)
Largest	-0.048	-0.049	-0.032	-0.028	0.026	0.033	-0.062	-0.054
	(-0.511)	(-0.519)	(-0.497)	(-0.431)	(0.256)	(0.327)	(-0.927)	(-0.804)
Constant	-0.880**	-0.889**	-0.187	-0.193	-1.334***	-1.307***	-0.999***	-0.993***
	(-2.430)	(-2.447)	(-0.763)	(-0.784)	(-3.597)	(-3.516)	(-4.027)	(-3.994)
Observations	2,900	2,900	2,900	2,900	2,810	2,810	2,810	2,810
Adjusted R-squared	0.063	0.062	0.055	0.055	0.059	0.060	0.069	0.069
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 17. 2016 inspections and 2017 inspections

Table 17 presents the subsample analysis regarding whether firms in provinces that were inspected in 2016 or 2017. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

	2016 Batches				2017 Batches			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$
*Inspection * PC*	0.028		0.035		0.113***		0.087***	
	(0.310)		(0.586)		(2.609)		(2.979)	
*Inspection * Achieved PC*		-0.095		-0.064		0.173***		0.131***
		(-0.898)		(-0.905)		(3.326)		(3.740)
*Inspection * Ascribed PC*		0.091		0.091		0.016		-0.005
		(0.566)		(0.849)		(0.253)		(-0.124)
PC	-0.070		-0.035		-0.077***		-0.058***	
	(-1.007)		(-0.744)		(-2.632)		(-2.935)	
Achieved PC		-0.015		0.010		-0.103***		-0.088***
		(-0.183)		(0.182)		(-3.002)		(-3.793)
Ascribed PC		-0.042		-0.053		-0.028		0.017
		(-0.329)		(-0.622)		(-0.608)		(0.553)
Inspection	-0.169**	-0.146*	-0.090*	-0.073	-0.143***	-0.141***	-0.075***	-0.072***
	(-2.215)	(-1.937)	(-1.762)	(-1.454)	(-3.789)	(-3.798)	(-2.952)	(-2.886)
NCSKEW	-0.007	-0.010			0.048***	0.047***		
	(-0.234)	(-0.351)			(3.149)	(3.119)		
DUVOL			0.009	0.007			0.039***	0.038***
			(0.311)	(0.238)			(2.663)	(2.616)
Dturn	0.005	0.001	0.031	0.030	-0.123*	-0.121*	-0.086**	-0.084**
	(0.042)	(0.005)	(0.397)	(0.379)	(-1.942)	(-1.903)	(-2.003)	(-1.964)
RET	0.001	0.048	0.407	0.417	0.274	0.240	0.282	0.246
	(0.001)	(0.059)	(0.751)	(0.769)	(0.701)	(0.612)	(1.072)	(0.932)
Sigma	-0.777	-0.413	1.002	1.095	4.366*	4.156*	3.005*	2.797*
	(-0.161)	(-0.086)	(0.310)	(0.339)	(1.829)	(1.739)	(1.869)	(1.738)
BM ratio	-0.682***	-0.691***	-0.370***	-0.376***	-0.345***	-0.344***	-0.165**	-0.165**
	(-3.278)	(-3.318)	(-2.652)	(-2.689)	(-3.247)	(-3.238)	(-2.309)	(-2.304)

ABACC	-0.248	-0.263	-0.240	-0.243	0.192	0.197	0.135	0.135
	(-0.934)	(-0.989)	(-1.343)	(-1.365)	(1.390)	(1.421)	(1.444)	(1.450)
ROA	0.418	0.414	0.177	0.172	0.798***	0.799***	0.541***	0.538***
	(0.857)	(0.846)	(0.539)	(0.526)	(3.312)	(3.313)	(3.331)	(3.312)
Firm size	0.056**	0.058**	0.039**	0.040**	0.050***	0.049***	0.022**	0.021**
	(2.017)	(2.086)	(2.080)	(2.152)	(3.891)	(3.831)	(2.552)	(2.474)
Leverage	-0.136	-0.141	-0.060	-0.065	-0.323***	-0.325***	-0.149**	-0.149**
	(-0.753)	(-0.777)	(-0.490)	(-0.534)	(-3.335)	(-3.357)	(-2.275)	(-2.276)
State Ownership	-0.130	-0.140	-0.096	-0.102	-0.035	-0.038	-0.001	-0.014
	(-1.123)	(-1.189)	(-1.235)	(-1.296)	(-0.627)	(-0.672)	(-0.034)	(-0.364)
Largest	-0.179	-0.179	-0.119	-0.120	-0.010	-0.008	-0.053	-0.048
	(-1.098)	(-1.092)	(-1.084)	(-1.095)	(-0.133)	(-0.112)	(-1.032)	(-0.933)
Constant	-0.704	-0.776	-0.591	-0.634	-1.196***	-1.180***	-0.601***	-0.587***
	(-1.141)	(-1.247)	(-1.428)	(-1.518)	(-4.192)	(-4.128)	(-3.127)	(-3.048)
Observations	1,230	1,230	1,230	1,230	4,480	4,480	4,480	4,480
Adjusted R-squared	0.048	0.047	0.046	0.046	0.063	0.063	0.065	0.066
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 18. Additional test between central- and local-political connections

Table 18 presents additional test regarding the difference between central-level and local-level political connections. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix B.

Variables	(1) $NCSKEW_{t+1}$	(2) $NCSKEW_{t+1}$	(3) $DUVOL_{t+1}$	(4) $DUVOL_{t+1}$	(5) $NCSKEW_{t+1}$	(6) $NCSKEW_{t+1}$	(7) $DUVOL_{t+1}$	(8) $DUVOL_{t+1}$
*Inspection * Central PC*	0.146**		0.109***					
	(2.497)		(2.761)					
*Inspection * Central Achieved PC*		0.107		0.095*				
		(1.434)		(1.888)				
*Inspection * Central Ascribed PC*		0.115		0.041				
		(1.104)		(0.583)				
*Inspection * Local PC*					0.076*		0.060**	
					(1.855)		(2.181)	
*Inspection * Local Achieved PC*						0.106**		0.072**
						(2.156)		(2.169)
*Inspection * Local Ascribed PC*						0.005		0.007
						(0.077)		(0.152)
Central PC	-0.157***		-0.102***					
	(-3.779)		(-3.626)					
Central Achieved PC		-0.116**		-0.088**				
		(-2.267)		(-2.543)				
Central Ascribed PC		-0.199***		-0.070				
		(-2.583)		(-1.345)				
Local PC					-0.054*		-0.044**	
					(-1.929)		(-2.308)	
Local Achieved PC						-0.089***		-0.070***
						(-2.688)		(-3.137)
Local Ascribed PC						0.021		0.029
						(0.436)		(0.910)
Inspection	-0.071	-0.067	-0.040	-0.037	-0.077	-0.074	-0.045	-0.042
	(-1.306)	(-1.229)	(-1.093)	(-1.002)	(-1.402)	(-1.358)	(-1.228)	(-1.134)
NCSKEW	0.036***	0.036***			0.038***	0.037***		

	(2.718)	(2.730)			(2.814)	(2.796)		
DUVOL			0.035***	0.035***			0.035***	0.035***
			(2.673)	(2.707)			(2.739)	(2.697)
Dturn	-0.092*	-0.092*	-0.057	-0.057	-0.087	-0.087	-0.053	-0.053
	(-1.661)	(-1.664)	(-1.530)	(-1.527)	(-1.568)	(-1.557)	(-1.414)	(-1.422)
RET	0.189	0.195	0.292	0.296	0.212	0.185	0.307	0.288
	(0.538)	(0.554)	(1.238)	(1.253)	(0.604)	(0.526)	(1.298)	(1.216)
Sigma	3.053	3.133	2.432*	2.480*	3.311	3.187	2.592*	2.520*
	(1.433)	(1.471)	(1.696)	(1.729)	(1.553)	(1.492)	(1.806)	(1.754)
BM ratio	-0.420***	-0.420***	-0.207***	-0.206***	-0.405***	-0.405***	-0.200***	-0.201***
	(-4.450)	(-4.456)	(-3.266)	(-3.249)	(-4.304)	(-4.301)	(-3.153)	(-3.168)
ABACC	0.077	0.078	0.041	0.042	0.086	0.084	0.047	0.044
	(0.632)	(0.639)	(0.497)	(0.512)	(0.700)	(0.688)	(0.569)	(0.539)
ROA	0.745***	0.738***	0.482***	0.479***	0.749***	0.740***	0.484***	0.473***
	(3.463)	(3.428)	(3.327)	(3.307)	(3.481)	(3.436)	(3.340)	(3.264)
Firm size	0.054***	0.053***	0.026***	0.025***	0.048***	0.048***	0.023***	0.023***
	(4.611)	(4.538)	(3.306)	(3.206)	(4.173)	(4.156)	(2.938)	(2.935)
Leverage	-0.286***	-0.286***	-0.129**	-0.127**	-0.272***	-0.273***	-0.121**	-0.122**
	(-3.372)	(-3.368)	(-2.255)	(-2.220)	(-3.208)	(-3.221)	(-2.129)	(-2.146)
State Ownership	-0.054	-0.050	-0.021	-0.020	-0.039	-0.055	-0.013	-0.030
	(-1.084)	(-0.997)	(-0.612)	(-0.586)	(-0.789)	(-1.079)	(-0.401)	(-0.875)
Largest	-0.024	-0.024	-0.049	-0.049	-0.032	-0.024	-0.054	-0.046
	(-0.352)	(-0.344)	(-1.075)	(-1.064)	(-0.465)	(-0.349)	(-1.184)	(-1.003)
Constant	-1.184***	-1.174***	-0.638***	-0.629***	-1.070***	-1.069***	-0.573***	-0.577***
	(-4.553)	(-4.510)	(-3.646)	(-3.587)	(-4.158)	(-4.148)	(-3.306)	(-3.324)
Observations	5,710	5,710	5,710	5,710	5,710	5,710	5,710	5,710
Adjusted R-squared	0.059	0.058	0.059	0.058	0.057	0.057	0.058	0.059
Province-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Chapter Four
Essay Three

The final essay regarding the relationship between EPU exposure, corporate environmental investment, and firm size is presented in Chapter Four. A brief overview of the final essay is presented in the introduction. Literature review and hypothesis development are then discussed. The next two sections introduce the sample and variable construction, research methodology, and discuss the results. The essay's reference is listed in the final section of this thesis.

Economic policy uncertainty exposure and corporate green investment: does firm size matter?

Abstract

This study examines the impact of firms' heterogenous exposure to economic policy uncertainty (EPU) on corporate environmental investment. We find that small firms are associated with lower levels of environmental investment in general compared to large firms. However, small firms are more likely to increase their environmental investment when facing higher EPU exposure. Our finding remains robust after constructing a series of robustness checks, including adopting alternative measures of EPU exposure and firm size, employing industry-adjusted investment, and using the Propensity score matching (PSM) approach. In cross-sectional analyses, we find that the effect of EPU exposure on environmental investment is more pronounced for small firms associated with lower financial constraints, located in regions with low levels of marketisation, owned by the state, and operating in non-heavily polluting industries. In addition, we investigate the reason for increasing environmental investment and find a positive relationship between environmental investment and the acquisition of new bank loans by small firms. Overall, this study provides implications of considering environmental engagement as a strategic action for small firms in times of uncertainty.

1. Introduction

Government policies, such as regulatory, fiscal, monetary, and tax affairs, significantly influence economic conditions in which firms operate (He et al., 2020; Lou et al., 2022; Luo & Zhang, 2020). Consequently, macroeconomic policy uncertainties can introduce volatility and complexity into the corporate operating environment (Lou et al., 2022). Economic policy uncertainty (EPU) arises when government policies and regulatory frameworks are undefined and cannot be accurately predicted by market participants, creating risks and challenges for firms (Al-Thaqeb & Algharabali, 2019; He et al., 2020). As such, there is a growing interest in understanding the consequences of policy uncertainties and their impact on firm behaviours.

Recent studies find that EPU significantly influences corporate decision-making, including investment decisions (Chen et al., 2019; Gulen & Ion, 2015; Kong et al., 2022; Wang et al., 2014; Xie et al., 2019), innovative behaviours (Cui et al., 2021; He et al., 2020; Liu et al., 2022b; Lou et al., 2022), risk-taking (Zhang et al., 2021), earnings management (Cui et al., 2020; Yung & Root, 2019), information disclosure (Nagar et al., 2019), and cash holdings (Phan et al., 2019). Focusing on stock markets, EPU has a substantial effect on firms' market value (Yang et al., 2019), stock excess returns and crashes (Jin et al., 2019; Luo & Zhang, 2020; Phan et al., 2018), as well as, stock price bubbles (Cheng et al., 2021). In addition, current studies also find that EPU is related to firms' productivity (Li et al., 2021), tax burden (Dang et al., 2019), financial constraints (Ma & Hao, 2022), and trade credit (Jory et al., 2020). Besides, EPU also increases the cost of debt (Tran, 2021) and shapes corporate financing decisions such as debt and equity financing (Tabash et al., 2022).

However, the impact of policy uncertainties on environment-related firm decisions is still underexplored (Hou et al., 2022). Although recent studies find that macro-level EPU negatively affects corporate green attitudes (Hou et al., 2022) and environmental innovation (Kyaw, 2022), little attention is given to how a firm's heterogeneous exposure to policy

uncertainties affects corporate environmental decisions. Firms have different levels of exposure to policy uncertainties due to their unique characteristics (Liu et al., 2017; Ma & Hao, 2022; Wang et al., 2014), industrial differences, geographic variations, stakeholder relationships (Hou et al., 2022; Jin et al., 2019; Xu et al., 2023), and so on. Consequently, firms make decisions based on their sensitivity to uncertainties (Yang et al., 2019). This study aims to examine the impact of firms' exposure to policy uncertainties on corporate environmental behaviours, with a focus on the differential effects of firm size.

Ball et al. (2021) suggest that firm size is an important determinant of firm-level sensitivity to macroeconomic shocks. This raises the question of whether firm size plays a significant role in shaping the impact of EPU on environmental investment decisions. A growing body of studies demonstrates that small firms are more sensitive to and more affected by the changes in economic-related policies (Demir & Ersan, 2017; Doan et al., 2020; Fan et al., 2021; Ghosal & Ye, 2014; Hassen & Hamdi, 2021; Mbanyele, 2021; Naes et al., 2011). On the one hand, less market access and insufficient bargaining power increase financing costs for small firms due to increased uncertainties (Bajaj et al., 2021; Gertler & Gilchrist, 1994). Chittenden and Derregia (2015) illustrate that small firms tend to delay capital decisions due to policy uncertainties. Consequently, small firms with higher exposure to uncertainties may reduce environmental investment. On the other hand, green engagement can be used as a strategy to enhance firm performance (Ling, 2019) and improve corporate competitiveness (Papadas et al., 2019). Since uncertainties are often associated with opportunities (Tarkom & Ujah, 2023), small firms are more likely to adopt active strategies and behave optimally to increase investment efficiency because they cannot afford to wait (Cao et al., 2020; Clemens et al., 2008). For example, firms may take more environmental-friendly actions to enhance their reputation in times of uncertainty (Hou et al., 2022). As a result, small firms with higher exposure to policy uncertainties are also likely to increase environmental investment. Therefore,

the relationship between EPU exposure, environmental investment, and firm size remains an open question.

To answer the above question, we use a sample of Chinese listed firms from 2000 to 2019. We choose the Chinese market for two reasons. First, the massive policy changes over past decades make China's EPU highly variable over time (see Figure 1), which provides an ideal setting for this study. China's economy has entered the "new normal of Chinese economic growth" with characteristics of the "three-phase superposition" period, including the phase of shifting the economic growth rate from high speed to medium-to-high speed, the phase of structural adjustment with growing pains, and the phase of digestion period of the initial stimulating policies (Peters, 2022; Yu & Shen, 2020). Subsequently, the government introduced a series of policies and reforms, such as Mass Entrepreneurship and Innovation, the Belt and Road Initiative, and Supply-side Reform (Liu et al., 2022b). Meanwhile, to promote the green transformation of the economy, the Chinese government also implemented several green policies, including the Green Credit Policy and a series of policies to achieve carbon peak and carbon neutrality. [36] Frequently introducing policies and multiple goals of macroeconomic objectives lead to high uncertainty around economic policies (Gulen & Ion, 2015; Liu et al., 2022b). Consequently, firm behaviours are likely to be affected. Second, small firms play an increasingly important role in the development of China's economy (Li et al., 2019; Siu, 2001). At the end of 2014, micro, small and medium-sized enterprises contributed 65% of China's GDP, 50% of the taxation revenue, 68% of national exports, and over 75% of total employment (Meng et al., 2018). Sjöholm and Lundin (2010) also find that small firms in China play an important part in science and technology development. Given China's current background of economic development with multiple policies and reforms implemented, it is critical to understand small firms' behaviours. As such, using the Chinese market can provide

[36] For instance, the Chinese government launches the "1+N" Policy Framework to achieve a low-carbon economy.

insights to other emerging markets with similar characteristics to support the development of small firms.

[Insert Figure 1 here]

We find that small firms are associated with lower levels of environmental investment compared to large firms. However, small firms tend to increase environmental investment when subject to higher EPU exposure. This finding implies that small firms may strategically respond to high EPU exposure through environmental investment, thereby supporting the argument that small firms are more sensitive to changing policies (Fan et al., 2021; Hassen & Hamdi, 2021; Mbanyele, 2021) and should respond actively to seize opportunities in times of uncertainty (Cao et al., 2020; Clemens et al., 2008; Tarkom & Ujah, 2023). Our finding remains robust after constructing a series of robustness tests, including using alternative measures of EPU exposure, industry-adjusted investment, alternative measure of firm size, and propensity score matching (PSM) method. In the cross-sectional analyses, we further examine the factors influencing the effect of EPU exposure on environmental investment. We find that the impact is more salient in small firms with lower financial constraints, located in regions with low levels of marketisation, owned by the state, and operating in non-heavily polluting industries. Lastly, we construct an additional test to explore the reason for increasing environmental investment and find a positive relationship between environmental investment and the acquisition of new bank loans by small firms, which sheds light on the strategic role of environmental investment.

This study contributes to the literature in several aspects. First, the influence of EPU on investment decision-making is one of the important research questions in the field of empirical research (Liu et al., 2022b). However, limited studies shed light on corporate environmental engagement. The literature reveals that macro-level policy uncertainties affect corporate environmental information disclosure (Pan et al., 2020), firms' green attitudes (Hou et al., 2022), and environmental innovation (Kyaw, 2022; Yang et al., 2022). Little is known

concerning the impact of EPU on environmental investment, especially in relation to the heterogeneous exposure of firms. Our study adds new evidence to the literature regarding how firms' heterogeneous exposure to uncertainties affects corporate investment strategies.

Second, few studies investigate whether firm size matters to the impact of policy uncertainties on environmental investment. This study contributes to the growing literature on understanding the wide-ranging effects of firms' EPU exposure. It highlights the importance of considering firm-specific characteristics when examining the impact of policy uncertainties on firm decision-making. Small firms face more challenges in uncertain environments, such as limited market access and insufficient bargaining power (Bajaj et al., 2021; Gertler & Gilchrist, 1994). Therefore, small firms are more sensitive to changing policies (Fan et al., 2021; Hassen & Hamdi, 2021; Mbanyele, 2021) and are advised to adopt proactive strategies to seize opportunities in times of uncertainty (Cao et al., 2020; Clemens et al., 2008; Tarkom & Ujah, 2023). In line with this argument, our study provides evidence that increasing environmental investment could be used as a strategic action by small firms, providing benefits such as more access to loans. Small businesses play a vital role in the economy because they contribute significant value to various sectors in most economies (Mazzarol & Reboud, 2020; Schich, 2017) and promote sustainable development (Mahmud et al., 2020). Given that small firms play an important role in market development, such as promoting technological innovation and economic growth, it is crucial to understand their behaviour to gain insight for both developing and developed countries (Acs et al., 1997; Day, 2000; Hoffman et al., 1998; Lee, 1995). Therefore, this study not only provides implications to policymakers that policy uncertainties affect small firms' investment behaviours but also provides implications to small firms of employing environmental engagement as a potentially strategic action when facing higher exposure to uncertainties.

The remainder of the paper is organised as follows. Section 2 presents the literature and hypothesis development. Section 3 illustrates the data and sample construction. Section 4 reports the empirical analyses and discusses the results. Section 5 concludes.

2. Literature review and hypothesis development

2.1. Current studies on EPU

The literature reveals that EPU has a wide impact on corporate decision-making (Li et al., 2021). For instance, existing studies find a significant impact of policy uncertainties on corporate investment activities (An et al., 2016; Gulen & Ion, 2015; Kong et al., 2022; Wang et al., 2014; Xie et al., 2019). Gulen and Ion (2015) illustrate that policy uncertainty induces corporate precautionary delays in investment because of investment irreversibility. As a result, firms tend to reduce investment when the level of policy uncertainty is high. Consistently, Chen et al. (2019) find that EPU decreases not only firms' long-term investment but also short-term investment. Using a sample of Chinese high-tech firms, Liu et al. (2022b) demonstrate that EPU shapes corporate investment preferences by inhibiting maintenance investment and stimulating innovation investment. EPU also affects corporate innovation activities (He et al., 2020; Kyaw, 2022; Lou et al., 2022). For example, He et al. (2020) illustrate that EPU has a positive impact on corporate innovation.

Further, the increase in EPU also discourages firm-level green attitudes (Hou et al., 2022) and hinders firms' total factor productivity growth (Li et al., 2021). However, firms with aggressive strategies may adopt EPU as an opportunity to compete in the changing environment, leading to more corporate risk-taking behaviours when EPU is high (Zhang et al., 2021). The uncertainties in the future economic policy also affect firm expectations and managerial judgements (Yung & Root, 2019), leading to different financial policies and decisions. For example, Tabash et al. (2022) show that EPU shapes corporate financing decisions such as debt and equity financing. Yung and Root (2019) demonstrate that firms tend to increase earnings

management when policy uncertainty is high. Nagar et al. (2019) find that managers increase their voluntary disclosures to reduce information asymmetry associated with increased EPU.

In addition, a rise in EPU also exacerbates corporate financial constraints (Ma & Hao, 2022), increases the tax burden (Dang et al., 2019), and adversely affects firms' trade credit (Jory et al., 2020). Using an international setting of 17 countries, Tran (2021) finds that high EPU leads to higher default risk and creditors increase the cost of debt to compensate for the information disadvantage associated with EPU. Consequently, EPU positively affects firms' cost of debt. Phan et al. (2019) argue that cash reserves not only buffer against financial shocks and maintain smooth operations but also provide flexibility that allows firms to exploit future profitable investment opportunities when uncertainty recedes. Hence, firms tend to increase cash holdings when policy uncertainties are high. Moreover, fluctuations in economic policy also affect stock markets. Phan et al. (2018) show that EPU affects stock excess returns using global evidence from 16 countries. Jin et al. (2019) and Luo and Zhang (2020) find that EPU may enhance the managerial ability and incentives to conceal bad news, which makes firms more prone to crash risk.

While a wide range of studies examines how policy uncertainties affect corporate decision-making using the macro-level EPU, it has been noticed that individual firms may have heterogeneous exposure to EPU based on their own characteristics (Cui et al., 2021). Therefore, corporate decision-making may vary among firms due to the heterogeneous exposure. Existing literature illustrates that firms with high EPU exposure are associated with less corporate innovative investment (Cui et al., 2021) and more earnings management (Cui et al., 2020). Studies also find that firms' heterogenous exposure to EPU exacerbates firms' stock price bubbles (Cheng et al., 2021) and decreases firms' market value (Yang et al., 2019). As for stock markets, Li (2017) finds that firms with higher EPU exposure earn higher average returns, and the EPU factor-mimicking portfolio earns significant abnormal returns.

2.2. Hypothesis development

Compared with large firms, small firms tend to be more sensitive to changes in economic-related policies (Doan et al., 2020; Ghosal & Ye, 2014; Hassen & Hamdi, 2021; Naes et al., 2011). For example, Demir and Ersan (2017) find that small firms tend to hold more cash in periods of high EPU. Mbanyele (2021) shows that EPU leads to higher stock illiquidity in small firms.

Although existing studies illustrate that EPU has different influences on corporate decisions in large and small firms, how small firms' exposure to EPU affects environmental investment is still an open question. On the one hand, EPU increases the cost of capital and instability of future cash flows for firms, especially small firms. According to Bajaj et al. (2021) and Gertler and Gilchrist (1994), small firms in times of uncertainty are associated with higher costs of external financing due to limited market access and bargaining power. Consequently, short of funds may lead to delayed capital decisions (Chittenden & Derregia, 2015). Kong et al. (2022) indicate that firms facing high uncertainties tend to reduce environmental projects to avoid risk because environmental projects do not generate direct economic effects. Therefore, due to the increased financing costs in small firms and the nature of the irreversibility of investment, it is likely that small firms with higher EPU exposure decrease corporate environmental investment to reduce operational risks. As such, we propose the following hypothesis:

Hypothesis 1(a): Compared with large firms, small firms with higher EPU exposure are associated with lower environmental investment.

On the other hand, since environmental protection tends to be one of the government's tasks, environmental investment could be used as a strategy to facilitate firm development and provide an insurance-like effect when there are uncertainties. For example, existing studies show that corporate green engagement can improve corporate performance and

competitiveness (Ling, 2019; Papadas et al., 2019). Hou et al. (2022) find that firms behave in an environmental-friendly manner to enhance their reputation in periods of high EPU. Compared with large firms, Tarkom and Ujah (2023) suggest that small firms should be more forward-looking to make strategic decisions to seize opportunities in times of uncertainty. Similarly, Cao et al. (2020) and Clemens et al. (2008) demonstrate that small firms facing uncertainties are more likely to implement active strategies and invest efficiently because they cannot afford to wait as large firms. More importantly, small firms may use environmental engagement to mitigate financial burdens. For instance, Fan et al. (2021) find that small firms are associated with lower financing costs if they are willing to improve environmental performance. As such, small firms may use environmental investment as an insurance and value-enhancing tool when they are with higher exposure to EPU, which leads to the following hypothesis:

Hypothesis 1(b): Compared with large firms, small firms with higher EPU exposure are associated with higher environmental investment.

3. Sample and variable construction

3.1. Data and sample

The initial sample used in this study consists of all publicly listed Chinese firms on the Shanghai and Shenzhen Stock Exchanges from 2000 to 2019. We manually collect the firm-level environmental investment data for all listed firms from their annual reports. The EPU index is obtained from the website (www.policyuncertainty.com) developed by Baker et al. (2016). All the other firm-level financial data are obtained from the China Stock Market and Accounting Research (CSMAR) database. After removing firms from the financial industry, firms that have been delisted, firms with missing environmental investment, and observations with missing information, the final sample includes 1,366 firms from 2000 to 2019,

corresponding to 6,222 firm-year observations from 15 industries. All continuous variables are winsorised at the 1% and 99% levels.

3.2. Variable construction

3.2.1. Environmental investment

We manually collect data of corporate environmental investment from "construction in progress" on a firm's annual report. Specifically, following studies such as Chen and Ma (2021), Liu et al. (2022a), Wang et al. (2022), and Zhang et al. (2019), we identify investment items related to environmental projects and environmental protection from the detailed items under this account, such as desulfurisation projects, denitrification projects, sewage treatment, waste gas treatment, dust and haze management, energy-saving, or greening projects. We then aggregate all related investment items as the firm's environmental investment. Finally, we construct two variables to measure corporate environmental investment. ENV/TA_{t+1} is a firm's environmental investment scaled by its total assets in year *t+1*. ENV/SA_{t+1} refers to the ratio of a firm's environmental investment to its total sales revenue in year *t+1*.

3.2.2. EPU exposure and small firms

Baker et al. (2016) construct time-varying EPU indices based on newspaper coverage for major economies, which is widely used in related studies (e.g., Cui et al., 2021; Kong et al., 2022; Li et al., 2021; Liu et al., 2022b; Ma & Hao, 2022; Yang et al., 2019; Zhang et al., 2021). Similarly, to measure China's EPU index, Davis et al. (2019) quantify uncertainty-related concepts using two mainland Chinese newspapers, the *Renmin Daily* and the *Guangming Daily*.[37] According to Cui et al. (2020), the *Renmin Daily* and the *Guangming Daily* are the two most influential news outlets that relay government policies in mainland China. Therefore,

[37] The detailed construction of the EPU index in mainland China is available in https://www.policyuncertainty.com.

we use the EPU index constructed by Davis et al. (2019) to measure the macro-level EPU in China.

Following Bonaime et al. (2018), Cui et al. (2020), Francis et al. (2014), and Nagar et al. (2019), we estimate firms' heterogenous exposure to EPU by running the following model for each firm using monthly data:

$$R_{i,\tau} - r_{i,\tau} = \beta_0 + \beta_{i,\tau}^{EPU} EPU_\tau + \beta_{i,\tau}^{MKT} MKT_\tau + \beta_{i,\tau}^{SMB} SMB_\tau + \beta_{i,\tau}^{HML} HML_\tau + \varepsilon_{i,\tau} \quad (1)$$

where $R_{i,\tau} - r_{i,\tau}$ is the excess return on stock i in month τ, EPU_τ is China's EPU index in month τ, MKT_τ, SMB_τ, and HML_τ are Fama-French three factors in the Chinese stock market.

With Model (1), we use the 60-month (τ-60, τ-1) rolling window for each firm to estimate the beta of $\beta_{i,\tau}^{EPU}$. The beta captures firms' sensitivity to the changes in EPU. Similar in spirit to Francis et al. (2014), Luo and Zhang (2020), and Nagar et al. (2019), we use the absolute value of beta to measure firms' heterogenous exposure to EPU because both positive and negative coefficients capture a firm's sensitivity to EPU. The high absolute value of beta indicates that the underlying stock is significantly affected by EPU changes. Finally, we average the monthly data as the proxy for annual EPU exposure, which is $EPU\ Beta_{i,t}$. Therefore, firms with higher $EPU\ Beta_{i,t}$ are associated with higher EPU exposure.

Small firms are measured by the dummy variable $Small\ Firm_{i,t}$, which equals one if firm *i*'s total assets in year *t* is lower than the median level in the same industry, and zero otherwise (Chan et al., 2012; Lu et al., 2023; Tang et al., 2022; Zheng et al., 2021).

3.2.3. Control variables

Referring to Chen et al. (2021), Xiao and Shen (2022), Huang and Lei (2021), Liu et al. (2022a), and Wang and Zhang (2020), we control for a set of firm characteristics that may affect corporate environmental investment. *Leverage* refers to the ratio of total debt to total assets. *Firm Age* is calculated as the natural logarithm of the years a firm has been established. *ROA* is the proxy of firm performance and is defined as the ratio of net income to total assets.

Tobin's Q is the ratio of the total market value of equity to the total book value of assets at the end of each year. *Return* refers to a firm's annual stock return. *Capex* is the capital expenditure scaled by total assets. *Cash Flow* is the ratio of cash flow from operations to total assets. *Sales Growth* is the annual growth rate in revenues. The detailed definitions of all variables used in this study are provided in Appendix C1.

4. Empirical analysis

4.1. Descriptive statistics

We present the summary statistics of the main variables used in this study in Panel A of Table 1. The average values of ENV/TA_{t+1} and ENV/SA_{t+1} are 0.012 and 0.028, respectively. Around 33% of the sample firms used in this study are small firms. On average, the mean value of $EPU\ Beta_{i,t}$ is 0.041 and the leverage ratio is 49.3% with a range from 5.5% to 100.3%. Sample firms have an average age of 14.8 years since their establishment, with a minimum age of 3.5 years and a maximum age of 31 years. As for firm performance, the average ROA is 0.033, the average Tobin's Q is 1.831, and firms have an average stock return of 0.191. The annual capital expenditure is 6.2% of total assets, and the annual cash flow from operations is 5.5% of total assets. Additionally, sample firms have an annual sales growth rate of 18.8%. Panel B of Table 1 reports the univariate analysis of firm characteristics regarding firm size. We find preliminary results that small firms have higher EPU exposure compared to large firms, indicating that small firms are more sensitive to EPU. Figure 2 also illustrates firms' EPU exposure by size and shows that small firms have higher EPU exposure over time. The univariate analysis also shows that the leverage ratio, ROA, capital expenditure, cash flow, and sales growth in small firms are lower than that in large firms, but small firms are associated with higher Tobin's Q and stock return. Besides, ENV/SA_{t+1} in small firms is higher on the average level. However, investment decisions are affected by many factors that are not captured

by firm size alone, we use regression analysis to further address the confounding effects of other firm characteristics in the next section.

[Insert Table 1 and Figure 2 here]

Table 2 reports the correlation matrix for the main variables and shows that multicollinearity is not a concern in this study. In addition, we find that *Small Firm* is positively correlated with *EPU beta* at the 1% significance level, which implies the significant influence of EPU on small firms.

[Insert Table 2 here]

4.2. Baseline findings

To examine the relationship between firms' heterogeneous exposure to economic policy uncertainties, corporate environmental investment, and firm size, we construct Model (2) as follows:

$$Env\ Inv_{i,t+1} = \beta_0 + \beta_1 Small\ Firm_{i,t} \times EPU\ Beta_{i,t} + \beta_2 Small\ Firm_{i,t} + \beta_3 EPU\ Beta_{i,t} + \sum_k \beta_k Controls_{i,t} + Fixed\ Effects + \varepsilon_{i,t} \quad (2)$$

where $Env\ Inv_{i,t+1}$ is the proxy for corporate environmental investment in year *t+1*, measured by ENV/TA_{t+1} or ENV/SA_{t+1}. $Small\ Firm_{i,t}$ is a dummy variable representing small firms as discussed. $EPU\ Beta_{i,t}$ is the measurement of firms' heterogeneous exposure to EPU, a higher value of $EPU\ Beta_{i,t}$ stands for higher level of EPU exposure. $Controls_{i,t}$ refers to a set of control variables discussed above. Firm- and year-fixed effects are included in Model (2) to control for time-invariant firm-level influences and potential time trend effects.

Our variable of interest is the interaction term $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$, which examines the impact of firm-level EPU exposure on corporate environmental investment in small compared to large firms. We expect the coefficient β_1 in Model (2) to be significantly

negative if *Hypothesis 1(a)* is supported and expect β_1 to be significantly positive if *Hypothesis 1(b)* is supported.

Table 3 reports the results of Model (2). Column (1) refers to the results using ENV/TA_{t+1} as the dependent variable, and Column (2) refers to the results employing ENV/SA_{t+1} as the dependent variable. We find that the coefficients on $Small\ Firm_{i,t}$ are significantly negative in Columns (1) and (2) at the 10% level and 5% level, respectively. The consistently negative coefficients on $Small\ Firm_{i,t}$ imply that small firms are associated with lower investment in environmental projects in general. The coefficients on $EPU\ Beta_{i,t}$ are statistically insignificant, which implies that predicting the impact of EPU exposure on environmental investment can be challenging. As discussed, firms with different characteristics may have different decision-makings concerning environmental engagement in times of uncertainty, which highlights the importance of identifying the factors that affect this relationship. Therefore, we particularly focus on firm size using the interaction term $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$. We find the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are significantly positive in Columns (1) and (2) at the 10% level and 5% level, respectively. The positive coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ indicate that small firms are more likely to increase their environmental investment when they are subject to higher EPU exposure.[38] In addition, we also find some evidence showing that firm characteristics such as leverage, age, capital expenditure are related to corporate environmental investment. For example, the significantly negative coefficient on *Leverage* implies that firms tend to decrease environmental investment when their leverage ratio is high. The significantly positive coefficient on *ROA* indicates that firms with higher profitability are more likely to invest in environment-related projects.

[38] We also construct detailed test regarding different components of environmental initiatives instead of using the aggregated investment items related to environmental projects. We report the results in Appendix C2.

Overall, the results in Table 3 support *Hypothesis 1(b)* that although small firms are associated with lower levels of environmental investment compared to large firms, small firms tend to increase environmental investment when they are subject to higher exposure to EPU. This finding is in line with the argument that environmental engagement may help small firms regarding the influences of policy uncertainties (Hou et al., 2022; Ling, 2019; Tarkom & Ujah, 2023).

[Insert Table 3 here]

4.3. Robustness checks

We construct a series of robustness tests in this section, including employing alternative measures of EPU exposure, adjusting dependent variables by industry influences, and using the alternative measure of firm size.

4.3.1. Alternative measures of EPU exposure

We construct three alternative measures of EPU exposure in this section. In the previous section, we use the 60-month (τ-60, τ-1) rolling window for each firm to estimate the beta of $\beta_{i,\tau}^{EPU}$. Therefore, we first employ a shorter horizon to estimate EPU exposure. In particular, we use a 36-month (τ-36, τ-1) rolling window for Model (1) to re-estimate firms' EPU exposure, which produces $EPU\ Beta\ 36_{i,t}$. We then replace $EPU\ Beta_{i,t}$ in Model (2) with $EPU\ Beta\ 36_{i,t}$. Columns (1) and (2) of Table 4 report the results using the first alternative measure of EPU exposure. Consistent with the baseline finding, we find that the coefficients on *Small Firm* all remain significantly negative, and the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta\ 36_{i,t}$ all remain significantly positive.

Secondly, we re-construct EPU exposure by controlling for Fama-French five factors (Fama & French, 2015) with the following model:

$$R_{i,\tau} - r_{i,\tau} = \beta_0 + \beta_{i,\tau}^{EPU} EPU_\tau + \beta_{i,\tau}^{MKT} MKT_\tau + \beta_{i,\tau}^{SMB} SMB_\tau + \beta_{i,\tau}^{HML} HML_\tau + \beta_{i,\tau}^{RMW} RMW_\tau + \beta_{i,\tau}^{CMA} CMA_\tau + \varepsilon_{i,\tau} \quad (3)$$

where $R_{i,\tau} - r_{i,\tau}$ is the excess return on stock i in month τ, EPU_τ is China's EPU index in month τ. MKT_τ, SMB_τ, HML_τ, RMW_τ, and CMA_τ are Fama-French five factors in the Chinese stock market.

We employ the same approach as previously and obtain our second alternative measure of EPU exposure, which is $EPU\ Beta\ FF_{i,t}$. We then replace $EPU\ Beta_{i,t}$ in Model (2) with $EPU\ Beta\ FF_{i,t}$ and report the results in Columns (3) and (4) of Table 4. We find that our baseline finding remains unchanged. That is, although small firms are generally associated with lower levels of environmental investment, they tend to increase environmental investment when exposed to higher levels of EPU.

Lastly, considering the significant impact of economic policy fluctuations in the U.S. on global economies (Wang et al., 2014), and taking into account China's close economic ties with the U.S. through a wide range of international trades (Wu et al., 2019), we construct a refined measure of China's EPU following Gulen and Ion (2015). This measure effectively eliminates the contaminating part of the index by extracting the component of China's EPU index that is orthogonal to the U.S. EPU index. Specifically, we run a regression using China's EPU index as the dependent variable and the U.S. EPU index as the independent variable. We obtain the residuals from the regression and use the residuals as a refined measure of China's EPU. We then replace China's EPU index in Model (1) with the residuals and employ the same approach as in *Section 3.2.2.* to re-estimate EPU exposure, which produces $EPU\ Beta\ Clean_{i,t}$. Columns (5) and (6) present the results using $EPU\ Beta\ Clean_{i,t}$ in Model (2) and we find that small firms are no longer associated with lower levels of environmental investment when they are with high EPU exposure.

[Insert Table 4 here]

4.3.2. Industry-adjusted investment and alternative measure of firm size

To mitigate the potential industrial influences and capture the corporate environmental investment of a firm relative to its industry peers, we replace dependent variables used in Model (2) with industry-adjusted values following Zaman et al. (2021). That is, for each industry and year, we calculate the median level of environmental investment and subtract the industrial-median environmental investment from the firm-level environmental investment for the corresponding year, which produces *Adj. ENV/TA* $_{t+1}$ and *Adj. ENV/SA* $_{t+1}$. Columns (1) and (2) of Table 5 report the results. The coefficients on $Small\ Firm_{i,t}$ are significantly negative and the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are significantly positive. The results are consistent with our baseline finding.[39]

In addition to measuring firm size using asset value, we construct an alternative measure of firm size using the total number of employees (Audretsch & Elston, 2002; Beck et al., 2005). Existing Chinese studies classify firms with more than 2,000 employees as large firms (Kostka et al., 2013; Lu et al., 2021), so we construct $Alt\ Small\ Firm_{i,t}$ as an alternative measure of small firms. $Alt\ Small\ Firm_{i,t}$ is a dummy variable that equals one if firm *i*'s total employee in year *t* is lower than 2,000, and zero otherwise. We then replace $Small\ Firm_{i,t}$ with $Alt\ Small\ Firm_{i,t}$ in Model (2) and report the results in Columns (3) and (4) of Table 5. Using *ENV/TA* $_{t+1}$ as the dependent variable in Column (3), we find that the coefficient on $Alt\ Small\ Firm_{i,t}$ is negative and significant at the 10% level, the coefficient on $Alt\ Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ is positive and significant at the 10% level. The result is consistent with our baseline finding. However, we do not find significant results using *ENV/SA* $_{t+1}$ as the dependent variable.

[39] We also use industry-adjusted environmental investment in all subsample analyses, and the results remain unchanged. Results are not tabulated and available upon request.

Overall, the results in Table 4 and Table 5 show that our baseline finding remains robust after using various robustness checks. The evidence supports *Hypothesis 1(b)* that small firms tend to increase environmental investment when they are with high EPU exposure.

[Insert Table 5 here]

4.3.3. Propensity score matching (PSM)

We also apply the propensity score matching (PSM) approach to mitigate the potential sample selection bias by matching small firms to large firms using a set of firm characteristics. Specifically, to obtain the propensity score in the first stage analysis,[40] we construct a logit regression using $Small\ Firm_{i,t}$ as the dependent variable and a set of firm characteristics as used in Model (2) as control variables. We employ a one-to-one matching method without replacement. After obtaining the PSM score, we re-estimate Model (2) using the PSM sample and report the results in Table 6.

Panel A of Table 6 presents the balance test of the PSM approach. As reported in the unmatched sample, we find that treatment and control groups have significant differences in observable firm characteristics, such as leverage, ROA, Tobin's Q, stock return, capital expenditure, cash flow, and sales growth. However, the differences in control variables between treatment and control groups become all statistically insignificant using the PSM sample, with the exception of *Leverage*. As such, the treatment and control groups have similar observable firm characteristics after the PSM. Panel B of Table 6 reports the regression results using the PSM sample. We find that small firms with high EPU exposure are associated with more environmental investment, which supports our baseline finding.

[Insert Table 6 here]

[40] Results of the first stage analysis are not tabulated and available on request.

4.4. Subsample analysis

4.4.1. The impact of financial constraints

Our baseline finding shows that small firms with higher EPU exposure are more likely to increase environmental investment, which supports our argument that environmental investment may have an insurance-like effect and could be used by small firms as an active strategy. However, as discussed, small firms are associated with challenges such as limited access to external sources of finance compared with large firms (Bajaj et al., 2021). Therefore, we examine the impact of financial constraints on our baseline finding in this section.

Following Shi et al. (2023), we use the FC index as the proxy for financial constraints. According to Shi et al. (2023), the FC index is well applicable to the Chinese capital market because it is estimated based on the characteristics of Chinese listed companies. Specifically, the FC index is constructed as the probability (*P*) of financing constraints occurring for each year of the firm. The probability (*P*) is obtained using the logit regression model as follows:

$$P\left(QUFC\middle|Z_{i,t}\right) = \frac{e^{Z_{i,t}}}{1+e^{Z_{i,t}}} \qquad (4)$$

$$Z_{i,t} = \partial_0 + \partial_1 Size_{i.t} + \partial_2 Lev_{i.t} + \partial_3\left(\frac{Dividend}{TA}\right)_{i.t} + \partial_4 MB_{i.t} + \partial_5\left(\frac{NWC}{TA}\right)_{i.t} + \partial_6\left(\frac{EBIT}{TA}\right)_{i.t}$$

where *QUFC* is the financial constraint dummy variable and is constructed by standardising three variables of firm size, firm age, and cash dividend payout ratio for each year and sorting the listed firms in ascending order based on the mean value of standardised variables. Terciles are then used as cutoff points to identify the level of financing constraints. Specifically, *QUFC* equals 1 for the high financially constrained group of listed firms in the bottom 66%, and 0 otherwise.

As such, the FC index has a value between 0 and 1. A higher value of the FC index represents a higher level of financial constraints that a firm has. We construct a subsample analysis and divide sample firms into two groups based on the median value of the FC index

for their industry in each year. Firms with FC index values higher than the median are classified as having high financial constraints (*High Financial Constraints*), while those with FC index values lower than the median are classified as having low financial constraints (*Low Financial Constraints*).

We report the results in Panel A of Table 7. Columns (1) and (2) represent firms with low financial constraints. We find that the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are significantly positive. Columns (3) and (4) refer to firms with high financial constraints, and we do not find any significant results.

Additionally, we also employ alternative measures of financial constraints that are used in the literature. The WW index (Livdan et al., 2009; Whited & Wu, 2006) is calculated as follows:

$$WW = -0.091 \times CF - 0.062 \times DivPos + 0.021 \times Lev - 0.044 \times Size + 0.102 \times ISG - 0.035 \times SG \quad (5)$$

where *CF* is the ratio of cash flow to total assets. *DivPos* is a dummy variable that equals one if cash dividends are distributed in the current year, and zero otherwise. *Lev* is the leverage ratio. *Size* refers to firm size. *ISG* represents the average sales growth rate of the industry. *SG* is the sales growth rate.

Hadlock and Pierce (2010) use firm size and firm age to estimate the degree of financial constraints and construct the SA index. In particular, the SA index is calculated as follows:

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.040 \times Age \quad (6)$$

The larger absolute value of the SA index indicates greater financial constraints. We report the subsample analyses using the WW index and SA index in Panels B and C, respectively. Consistently, we find that the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are only positive and significant when firms are associated with lower financial constraints.

Overall, the results in Table 7 indicate that the impact of EPU exposure on environmental investment is more pronounced for small firms with low financial constraints. This finding highlights the important role of financial constraints in shaping investment decisions of small firms.

[Insert Table 7 here]

4.4.2. The impact of marketisation

This section examines whether and how marketisation affects our baseline finding because the levels of marketisation are uneven across regions in China. Firms can benefit from a more liberal business environment and have better risk protection through the economic development of the local market (Yang et al., 2019). Policy uncertainties decrease the value of protections provided by the government, making regions with low levels of marketisation more vulnerable to uncertainties (Pástor & Veronesi, 2013; Wang et al., 2014). For example, Yang et al. (2019) find that EPU significantly affects firms' profit and financial conditions if they have less market-oriented business. Therefore, the impact of EPU tends to be more salient for firms located in regions with low levels of marketisation. If environmental investment could be considered as an insurance-like strategy, we expect that small firms with high EPU exposure would be more likely to increase their environmental investment in low-marketisation regions.

We employ the Marketisation Index developed by Wang et al. (2021) to measure the marketisation level of different regions in China. The index measures the regional market development based on five aspects, including the relationship between government and markets, the development of non-state-owned sectors in the economy, the development of product markets, the development of factor markets, and the development of market intermediaries and legal environment. High scores of the index indicate good institutional development. We then construct a subsample analysis based on the level of the regional marketisation index where a firm is located. *High Marketisation* includes firms if they are in

regions with an index higher than the national median value in a given year. *Low Marketisation* includes firms that are in regions with an index lower than the national median value in a given year.

We report the results in Table 8. Columns (1) and (2) refer to firms in low-marketisation regions. We find that the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are significantly positive. Columns (3) and (4) refer to firms in high-marketisation regions, however, we do not find any significant results. Overall, results in Table 8 indicate that small firms with high EPU exposure are more likely to increase environmental investment when they are in regions with low levels of marketisation, where the influence of visible hands is more salient. This finding aligns with the argument that high EPU exposure is related to high dependence on policy-related business (Bu et al., 2019; Yang et al., 2019), making environmental investment a strategic response to mitigate the shocks from uncertainties.

[Insert Table 8 here]

4.4.3. The impact of ownership structure

Next, we examine the impact of ownership type on our main findings. State-owned enterprises (SOEs) and non-SOEs may be subject to different degrees of EPU influence for several reasons. The inherent relationship between SOEs and the government tends to make corporate behaviours in SOEs more "pro-policy", rendering SOEs more easily affected by policy changes (Wang et al., 2014; Yang et al., 2019). In addition, Wang et al. (2014) argue that SOEs in China tend to be more affected by policy uncertainties because SOEs rely predominantly on bank lending, where Chinese banks are more responsive to policy changes. In support of these arguments, Jin et al. (2019) find that EPU has a greater impact on stock prices in SOEs. Consequently, it is possible that SOEs are more sensitive to EPU and take a more proactive approach by investing more in green projects as a responsive strategy compared to non-SOEs. Moreover, different access to external resources may also affect investment

choices of SOEs and non-SOEs when facing uncertainties. Compared with non-SOEs, SOEs are associated with less financial distress due to more access to preferential treatment, such as more subsidies and better access to financing (Beuselinck et al., 2017; Dong et al., 2021; He et al., 2016; Wu, 2017; Wu et al., 2021), which may enable SOEs to engage in more green investments. Therefore, this section aims to examine whether the ownership type affects our baseline finding and explores the potential variations resulting from ownership distinctions. Specifically, we identify a firm's ownership type according to the identity of its ultimate controller. A firm is categorised as SOE if it is ultimately controlled by the state, otherwise it is categorised as non-SOE.

We construct a subsample analysis between SOEs and non-SOEs and report the results in Table 9. The coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are statistically insignificant in Columns (1) and (2) but are significantly positive in Columns (3) and (4), indicating our baseline finding is more prominent in SOEs than in non-SOEs. Our find is also in line with Jin et al. (2019), Wang et al. (2014), and Yang et al. (2019) that firm decisions in SOEs are more affected by policy uncertainties.

[Insert Table 9 here]

4.4.4. The impact of industry properties

In addition to financial conditions, local marketisation levels, and ownership structure, small firms' environmental decisions may also be affected by industry properties, such as heavily and non-heavily polluting industries. We identify heavily polluting industries in accordance with the "*Catalogue of Classified Management of Environmental Protection Verification Industries of Listed Firms*" issued by the Ministry of Environmental Protection of China,[41] 16 industries are defined as heavily polluting industries, including thermal power, iron and steel, cement, electrolytic aluminium, coal, metallurgy, building material, mining,

[41] It is now the Ministry of Ecology and Environment of the People's Republic of China.

chemical, petrochemical, pharmaceutical, brewing, papermaking, fermentation, textile, and tanning. We construct subsample analysis based on whether firms belong to heavily or non-heavily polluting industries and report the results in Table 10.

Columns (1) and (2) present the regression results for firms in the non-heavily polluting industries and Columns (3) and (4) report the results for firms in the heavily polluting industries. We find that the coefficients on $Small\ Firm_{i,t} \times EPU\ Beta_{i,t}$ are significantly positive in Columns (1) and (2) but insignificant in Columns (3) and (4), indicating our baseline finding is more salient in firms in non-heavily polluting industries.

We find that small firms with high EPU exposure are associated with higher environmental investment in non-heavily polluting industries than in heavily polluting industries. One possible explanation is that firms in heavily polluting industries are usually the major source of environmental pollution, therefore, they are subject to more market scrutiny, strengthened supervision, and more stringent regulations than firms in other industries (Cho & Patten, 2007; Liu et al., 2022a; Ye et al., 2022). Consequently, firms in heavily polluting industries are inherently associated with more investments in environment-related projects due to regulation requirements, and they may have a more moderate response to uncertainties concerning the use of environmental investments compared to firms in non-heavily polluting industries. For instance, Yang et al. (2022) examine the impact of EPU on green technology innovation (GTI) in Chinese listed firms and find that EPU has a promoting effect on GTI. However, they find that the promoting effect is weaker in high-polluting firms than in other firms. Yang et al. (2022) argue that green innovation of high-polluting firms is less affected by EPU because such firms naturally invest more in GTI than other firms.

Another explanation could be the varying financial conditions across industries. Yao et al. (2021) find that green credit policy increases financial constraints in heavily polluting firms. Firms in heavily polluting industries may encounter more financial difficulties compared

to firms in non-heavily polluting industries. As such, the limited credit from banks may inhibit the use of environmental investment by polluting firms.

[Insert Table 10 here]

4.5. Additional analysis

Our findings so far support *Hypothesis 1(b)* that small firms may use environmental investment as a value-enhancing and insurance-like tool when they are with higher exposure to EPU. Therefore, we examine the possible channel in this section to further explore the potential benefits of environmental investment for small firms.

Environmental engagement can be regarded as strategic actions (Shu et al., 2019; Shu et al., 2014) because firms' environmental performance is a critical factor that influences lending decisions (Wellalage & Kumar, 2021) and lending conditions (Goss & Roberts, 2011). Firms with proactive environmental engagement are associated with lower levels of risk and more accessibility to the financial market (Wellalage et al., 2022). Zhang and Wellalage (2022) and Zhang et al. (2022) document that corporate environmental performance affects both debt and equity financing. Using international evidence of 30 countries, El Ghoul et al. (2016) demonstrate that higher corporate environmental responsibility is associated with the lower cost of equity capital. It has also been found that improving environmental performance lowers financing costs in small firms (Fan et al., 2021). Therefore, we examine whether environmental investment is related to better access to bank loans using the following model:

$$New\ Loan_{i,t} = \beta_0 + \beta_1 Small\ Firm_{i,t} \times Env\ Inv_{i,t} + \beta_2 Small\ Firm_{i,t} + \beta_3 Env\ Inv_{i,t} + \sum_k \beta_k Controls_{i,t} + Fixed\ Effects + \varepsilon_{i,t} \quad (7)$$

where $New\ Loan_{i,t+1}$ is calculated as the natural logarithm of new-obtained bank loan amount for firm i in year t following Xing et al. (2021). $Env\ Inv_{i,t}$ refers to *ENV/TA* and *ENV/SA*. Other variables are the same as described in Model (2).

If small firms use environmental investment as a strategic response to high EPU exposure, we expect β_1 to be positive. We report the results of Model (7) in Table 11.[42] We find that the coefficients on $Small\ Firm_{i,t}$ in Columns (1) and (2) are all negative and significant at the 1% level, indicating small firms are generally associated with less bank loans. The significantly positive coefficients on $Small\ Firm_{i,t} \times Env\ Inv_{i,t}$ indicate a positive association between the environmental investment and the acquisition of new bank loans by small firms, which might be a possible reason that small firms increase their environmental investment when subject to higher EPU exposure.

[Insert Table 11 here]

5. Conclusions

A growing body of studies demonstrates that small firms are more sensitive to and more affected by the changes in economic-related policies (Demir & Ersan, 2017; Doan et al., 2020; Fan et al., 2021; Ghosal & Ye, 2014; Hassen & Hamdi, 2021; Mbanyele, 2021; Naes et al., 2011). However, there is limited evidence on whether and how policy uncertainties affect corporate environmental behaviours in small firms, particularly considering the heterogeneous exposure of firms to uncertainties. Therefore, this study examines the impact of firms' heterogenous exposure to EPU on corporate environmental investment with respect to firm size.

We find that small firms are associated with lower environmental investment in general, but they are more likely to increase environmental investment when subject to higher EPU exposure. This result still holds after conducting a series of robustness tests. We further find that the effect of EPU exposure on environmental investment is more pronounced for small firms associated with lower financial constraints, located in regions with low levels of marketisation, ultimately owned by the state, and operating in non-heavily polluting industries.

[42] Due to data availability of new-obtained bank loans, after removing observations with missing information, there is a decrease in firm-year observations.

We also find evidence that small firms with higher environmental investment tend to have better access to bank loans.

Overall, this study highlights the importance of considering firm-specific characteristics when examining the impact of policy uncertainties on firm decision-making. It also provides insights that corporate environmental engagement could be used as strategic actions by small firms in uncertain environments, providing benefits such as more access to bank loans.

This study also has limitations that can be improved in the future. We argue that small firms with high EPU exposure tend to increase environmental investment as a strategic response to uncertainties. Supporting this argument, we find evidence showing that higher environmental investment is positively associated with the acquisition of new bank loans by small firms. However, more investigation is needed to understand the underlying reasons for employing environmental investment as a strategic decision in uncertain times. For instance, future research could explore whether firms with increased environmental investment are associated with lower financial costs, more access to green credit, or more government preferential treatments. By examining these aspects, future studies can provide a more comprehensive understanding of the strategic decision-making process for small firms in times of uncertainty.

Figure 1. EPU Index in China

Figure 1 presents China's EPU Index based on mainland newspapers from 2000 to 2019. EPU Index is obtained from https://www.policyuncertainty.com.

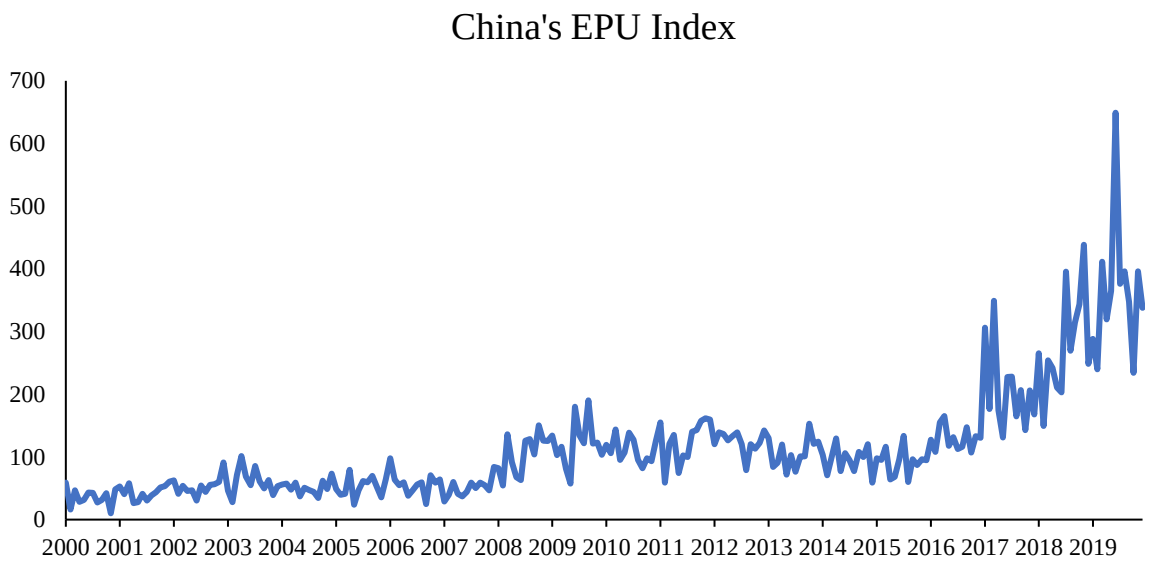

Figure 1

Figure 2. EPU exposure by firm size

Figure 2 illustrates firms' EPU exposure by firm size from 2000 to 2019. Solid line refers to small firms, dashed line refers to large firms.

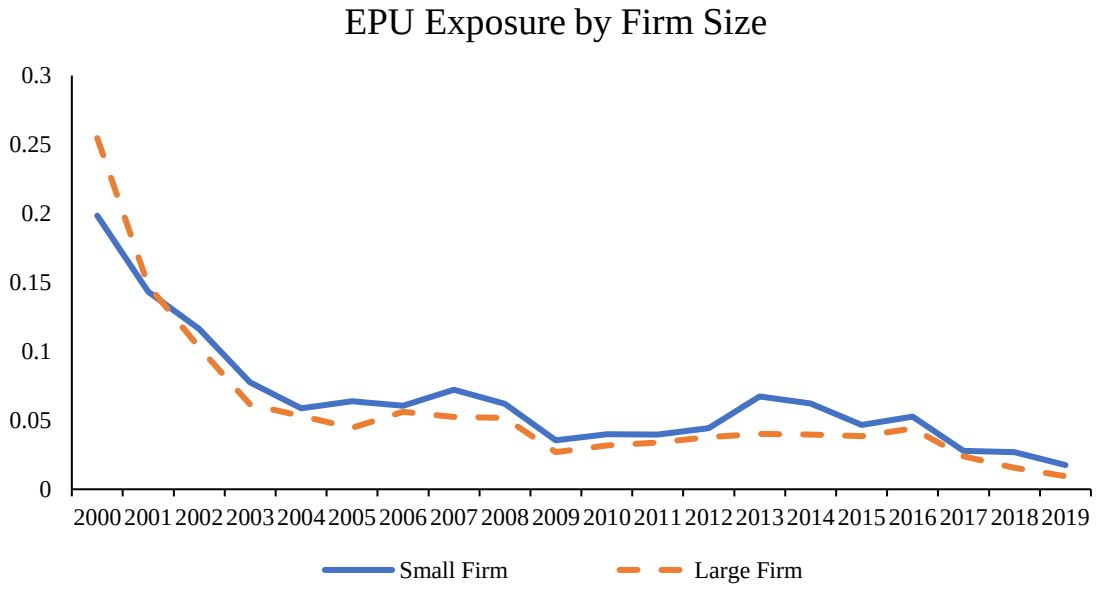

Figure 2

Table 1. Summary Statistics

Panel A of Table 1 presents the summary statistics of main variables used in this study. Panel B of Table 1 compares firm characteristics regarding firm size. The sample includes 6,222 firm-year observations from 2000 to 2019. The detailed variable definition of each variable is presented in Appendix C1.

Panel A: Summary statistics

Variables	N	Mean	SD	Min	P25	Median	P75	Max
ENV/TA $_{t+1}$	6,222	0.012	0.024	0.000	0.000	0.002	0.010	0.155
ENV/SA $_{t+1}$	6,222	0.028	0.072	0.000	0.001	0.004	0.019	0.490
Small Firm	6,222	0.330	0.470	0.000	0.000	0.000	1.000	1.000
EPU Beta	6,222	0.041	0.051	0.000	0.010	0.025	0.052	0.634
Leverage	6,222	0.493	0.188	0.055	0.356	0.503	0.634	1.003
Firm Age	6,222	2.700	0.414	1.253	2.468	2.774	2.998	3.441
ROA	6,222	0.033	0.057	-0.309	0.012	0.032	0.058	0.197
Tobin's Q	6,222	1.831	1.014	0.912	1.188	1.502	2.092	9.535
Return	6,222	0.191	0.677	-0.683	-0.244	0.010	0.395	2.888
Capex	6,222	0.062	0.057	-0.067	0.022	0.048	0.088	0.254
Cash Flow	6,222	0.055	0.067	-0.186	0.016	0.053	0.094	0.256
Sales Growth	6,222	0.188	0.398	-0.634	-0.001	0.123	0.285	3.379

Panel B: Univariate analysis

	Small Firm = 0		Small Firm = 1			
Variables	N	Mean	N	Mean	Mean-Diff	t
ENV/TA $_{t+1}$	4,171	0.011	2,051	0.012	-0.001	-1.443
ENV/SA $_{t+1}$	4,171	0.027	2,051	0.031	-0.004**	-2.130
EPU Beta	4,171	0.038	2,051	0.047	-0.009***	-6.606
Leverage	4,171	0.535	2,051	0.408	0.127***	26.519
Firm Age	4,171	2.703	2,051	2.693	0.010	0.882
ROA	4,171	0.036	2,051	0.027	0.009***	5.672
Tobin's Q	4,171	1.612	2,051	2.276	-0.664***	-25.517
Return	4,171	0.179	2,051	0.216	-0.037**	-2.001
Capex	4,171	0.064	2,051	0.058	0.007***	4.481
Cash Flow	4,171	0.057	2,051	0.051	0.006***	3.444
Sales Growth	4,171	0.194	2,051	0.175	0.020*	1.831

Table 2. Correlation Matrix

Table 2 reports the correlation matrix of main variables used in regression analysis. A detailed definition of all variables is reported in Appendix C1. *** indicates significance at the 1% level.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
(1) ENV/TA $_{t+1}$	1					
(2) ENV/SA $_{t+1}$	0.904***	1				
(3) Small Firm	0.018	0.027	1			
(4) EPU Beta	-0.004	-0.002	0.083***	1		
(5) Leverage	0.021	0.027	-0.319***	-0.055***	1	
(6) Firm Age	0.004	0.028	-0.011	-0.289***	0.048***	1
(7) ROA	0.016	-0.010	-0.072***	0.077***	-0.356***	-0.037***
(8) Tobin's Q	-0.027	-0.021	0.308***	0.073***	-0.320***	0.066***
(9) Return	0.000	-0.018	0.025	0.055***	0.017	-0.099***
(10) Capex	0.232***	0.231***	-0.057***	0.105***	-0.016	-0.211***
(11) Cash Flow	0.003	-0.031	-0.044***	0.013	-0.158***	-0.009
(12) Sales Growth	0.034***	0.014	-0.023	0.049***	0.043***	-0.099***

Table 2 (continued)

	(7)	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*
(7) ROA	1					
(8) Tobin's Q	0.179***	1				
(9) Return	0.150***	0.314***	1			
(10) Capex	0.144***	-0.015	0.024	1		
(11) Cash Flow	0.388***	0.107***	0.107***	0.165***	1	
(12) Sales Growth	0.222***	0.041***	0.104***	0.132***	0.045***	1

Table 3. Baseline results

This table presents the baseline regression results. The dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	(1)	(2)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
Small Firm EPU Beta*	0.024*	0.076**
	(1.837)	(2.049)
Small Firm	-0.002*	-0.009**
	(-1.907)	(-2.381)
EPU Beta	0.009	0.023
	(1.025)	(0.888)
Leverage	-0.008**	-0.006
	(-2.394)	(-0.639)
Firm Age	-0.007**	-0.011
	(-1.965)	(-1.037)
ROA	0.003	0.035*
	(0.422)	(1.681)
Tobin's Q	-0.000	-0.002
	(-0.354)	(-1.432)
Return	-0.000	0.000
	(-0.277)	(0.195)
Capex	0.065***	0.200***
	(10.574)	(11.505)
Cash Flow	-0.002	-0.028*
	(-0.296)	(-1.895)
Sales Growth	0.000	-0.004*
	(0.350)	(-1.907)
Constant	0.018**	0.024
	(2.299)	(1.121)
Observations	6,222	6,222
Adjusted R-squared	0.350	0.400
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Table 4. Alternative measures of EPU exposure

This table presents the results of Model (2) using different measures of EPU exposure. Dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *EPU Beta 36* represents firms' exposure to EPU estimated using the 36 month-window of Model (1). *EPU Beta FF* refers to EPU exposure estimated using Fama-French Five Factors. *EPU Beta Clean* measures firms' clean EPU exposure. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

Variables	(1) *ENV/TA* $_{t+1}$	(2) *ENV/SA* $_{t+1}$	(3) *ENV/TA* $_{t+1}$	(4) *ENV/SA* $_{t+1}$	(5) *ENV/TA* $_{t+1}$	(6) *ENV/SA* $_{t+1}$
*Small Firm * EPU Beta 36*	0.022**	0.067**				
	(2.005)	(2.150)				
*Small Firm * EPU Beta FF*			0.025**	0.074**		
			(1.977)	(2.082)		
*Small Firm * EPU Beta Clean*					0.030**	0.060
					(2.031)	(1.427)
Small Firm	-0.003*	-0.009**	-0.003**	-0.009**	-0.003**	-0.008**
	(-1.931)	(-2.377)	(-2.021)	(-2.438)	(-2.028)	(-2.039)
EPU Beta 36	-0.001	-0.003				
	(-0.163)	(-0.131)				
EPU Beta FF			0.011	0.028		
			(1.262)	(1.127)		
EPU Beta Clean					0.009	0.012
					(0.824)	(0.396)
Leverage	-0.008**	-0.006	-0.008**	-0.006	-0.008**	-0.006
	(-2.356)	(-0.608)	(-2.393)	(-0.639)	(-2.415)	(-0.650)
Firm Age	-0.008**	-0.012	-0.007*	-0.011	-0.007*	-0.011
	(-2.094)	(-1.161)	(-1.957)	(-1.029)	(-1.892)	(-1.032)
ROA	0.004	0.036*	0.003	0.035*	0.003	0.037*
	(0.500)	(1.747)	(0.417)	(1.681)	(0.447)	(1.761)
Tobin's Q	-0.000	-0.002	-0.000	-0.002	-0.000	-0.002
	(-0.344)	(-1.429)	(-0.326)	(-1.404)	(-0.464)	(-1.480)
Return	-0.000	0.000	-0.000	0.000	-0.000	0.001
	(-0.288)	(0.190)	(-0.297)	(0.178)	(-0.196)	(0.250)

Capex	0.065***	0.200***	0.065***	0.200***	0.065***	0.200***
	(10.585)	(11.508)	(10.577)	(11.506)	(10.507)	(11.446)
Cash Flow	-0.001	-0.028*	-0.002	-0.029*	-0.002	-0.029*
	(-0.275)	(-1.878)	(-0.313)	(-1.910)	(-0.337)	(-1.921)
Sales Growth	0.000	-0.004*	0.000	-0.004*	0.000	-0.004*
	(0.319)	(-1.938)	(0.371)	(-1.885)	(0.360)	(-1.887)
Constant	0.021***	0.032	0.017**	0.022	0.021***	0.034
	(2.739)	(1.509)	(2.206)	(1.035)	(2.830)	(1.624)
Observations	6,222	6,222	6,222	6,222	6,222	6,222
Adjusted R-squared	0.349	0.400	0.350	0.400	0.350	0.399
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 5. Industry-adjusted investment and alternative measure of small firms

This table presents the results of Model (2) using industry-adjusted dependent variables and alternative measure of small firms. *Adj. ENV/TA* $_{t+1}$ and *Adj. ENV/SA* $_{t+1}$ are industry-adjusted values. *Alt Small Firm* is a dummy variable that equals one if firm *i*'s total employee in year *t* is lower than 2,000, and zero otherwise. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	(1)	(2)	(3)	(4)
Variables	*Adj. ENV/TA* $_{t+1}$	*Adj. ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
Small Firm EPU Beta*	0.025*	0.084**		
	(1.941)	(2.283)		
Alt Small Firm EPU Beta*			0.021*	0.053
			(1.649)	(1.469)
Small Firm	-0.002*	-0.010***		
	(-1.905)	(-2.587)		
Alt Small Firm			-0.002*	-0.002
			(-1.853)	(-0.519)
EPU Beta	0.007	0.013	0.007	0.021
	(0.789)	(0.524)	(0.689)	(0.700)
Leverage	-0.007**	-0.004	-0.008**	-0.004
	(-2.276)	(-0.439)	(-2.475)	(-0.422)
Firm Age	-0.005	-0.007	-0.008**	-0.010
	(-1.428)	(-0.634)	(-1.973)	(-0.922)
ROA	0.002	0.029	0.004	0.040*
	(0.322)	(1.395)	(0.530)	(1.932)
Tobin's Q	-0.000	-0.001	-0.000	-0.002
	(-0.071)	(-0.929)	(-0.396)	(-1.599)
Return	-0.000	-0.000	-0.000	0.000
	(-0.494)	(-0.049)	(-0.317)	(0.154)
Capex	0.064***	0.197***	0.065***	0.201***
	(10.444)	(11.404)	(10.601)	(11.599)
Cash Flow	-0.001	-0.027*	-0.002	-0.029*
	(-0.178)	(-1.816)	(-0.334)	(-1.932)
Sales Growth	0.000	-0.004	0.000	-0.004*
	(0.552)	(-1.645)	(0.380)	(-1.810)
Constant	0.013*	0.013	0.017**	0.018
	(1.650)	(0.617)	(2.276)	(0.844)
Observations	6,222	6,222	6,222	6,222
Adjusted R-squared	0.321	0.362	0.350	0.400
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 6. Propensity score matching

This table reports the regression results using the PSM analysis. Panel A refers to the balance test of the PSM analysis. Panel B presents the regression results using the PSM sample. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

Panel A: The balance test of PSM analysis

	Unmatched (U)	Mean			% reduct	t-test	
Variable	Matched (M)	Treated	Control	%bias	|bias|	t	p>|t|
Leverage	U	0.408	0.535	-70.6		-26.52	0.000
	M	0.446	0.433	6.9	90.2	2.03	0.042
Firm Age	U	2.693	2.703	-2.4		-0.88	0.378
	M	2.686	2.682	1.0	56.5	0.29	0.773
ROA	U	0.027	0.036	-14.7		-5.67	0.000
	M	0.035	0.034	1.4	90.8	0.38	0.700
Tobin's Q	U	2.276	1.612	63.4		25.52	0.000
	M	1.934	1.952	-1.8	97.2	-0.56	0.575
Return	U	0.216	0.179	5.4		2.00	0.045
	M	0.194	0.187	1.1	79.5	0.31	0.759
Capex	U	0.058	0.064	-12.1		-4.48	0.000
	M	0.061	0.059	2.5	79.3	0.71	0.476
Cash Flow	U	0.051	0.057	-9.2		-3.44	0.001
	M	0.055	0.054	1.9	79.3	0.52	0.603
Sales Growth	U	0.175	0.194	-4.9		-1.83	0.067
	M	0.187	0.181	1.4	70.9	0.40	0.689

Panel B: PSM sample

	(1)	(2)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
Small Firm EPU Beta*	0.037*	0.102*
	(1.948)	(1.887)
Small Firm	-0.002	-0.003
	(-1.034)	(-0.555)
EPU Beta	-0.005	-0.007
	(-0.323)	(-0.157)
Leverage	0.003	0.024*
	(0.621)	(1.660)
Firm Age	-0.012*	-0.009
	(-1.894)	(-0.509)
ROA	0.015	0.065**
	(1.308)	(1.988)
Tobin's Q	-0.001	-0.005**
	(-1.538)	(-2.006)
Return	0.000	0.002

	(0.289)	(0.646)
Capex	0.073***	0.224***
	(7.494)	(8.108)
Cash Flow	-0.000	-0.038
	(-0.015)	(-1.638)
Sales Growth	0.002	-0.003
	(1.245)	(-0.948)
Constant	0.026**	0.024
	(2.112)	(0.683)
Observations	3,102	3,102
Adjusted R-squared	0.357	0.406
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Table 7. The impact of financial constraints

This table presents the subsample analysis regarding the impact of financial constraints. Panel A refers to the results using the FC index. Panel B reports the results using the WW index. Panel C presents the results using the SA index. Dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

Panel A: FC Index

	Low Financial Constraints		High Financial Constraints	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
*Small Firm * EPU Beta*	0.051**	0.187***	-0.007	0.012
	(2.008)	(2.782)	(-0.252)	(0.138)
Small Firm	-0.006**	-0.025***	-0.002	-0.013
	(-2.522)	(-3.913)	(-0.798)	(-1.618)
EPU Beta	0.005	0.016	0.036	0.074
	(0.494)	(0.625)	(1.338)	(0.902)
Leverage	-0.006	0.008	0.004	0.015
	(-1.456)	(0.781)	(0.474)	(0.686)
Firm Age	-0.011**	-0.022*	-0.015	-0.031
	(-2.383)	(-1.856)	(-1.608)	(-1.099)
ROA	0.001	0.009	0.016	0.118**
	(0.146)	(0.383)	(0.985)	(2.464)
Tobin's Q	0.000	0.001	0.000	-0.003
	(0.195)	(0.395)	(0.090)	(-1.138)
Return	0.000	0.001	-0.001	-0.000
	(0.344)	(0.256)	(-0.541)	(-0.076)
Capex	0.059***	0.179***	0.068***	0.212***
	(8.182)	(9.398)	(5.100)	(5.272)
Cash Flow	-0.007	-0.025	0.005	-0.040
	(-1.072)	(-1.566)	(0.445)	(-1.184)
Sales Growth	-0.001	-0.003	0.002	-0.003
	(-0.558)	(-1.403)	(1.460)	(-0.566)
Constant	0.027***	0.046*	0.015	0.026
	(2.920)	(1.917)	(0.879)	(0.501)
Observations	3,942	3,942	2,280	2,280
Adjusted R-squared	0.377	0.451	0.326	0.357
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Panel B: WW Index				
	Low Financial Constraints		High Financial Constraints	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
*Small Firm * EPU Beta*	0.056***	0.154***	-0.004	0.018
	(2.713)	(2.684)	(-0.157)	(0.248)
Small Firm	-0.003	-0.010*	-0.001	-0.006
	(-1.423)	(-1.680)	(-0.495)	(-0.999)
EPU Beta	0.014	0.043	0.015	0.017
	(1.416)	(1.524)	(0.685)	(0.260)
Leverage	-0.009**	-0.001	-0.009	-0.016
	(-2.111)	(-0.059)	(-1.511)	(-0.967)
Firm Age	-0.011**	-0.025*	-0.002	0.008
	(-2.338)	(-1.909)	(-0.200)	(0.352)
ROA	0.008	0.023	-0.001	0.043
	(0.563)	(0.604)	(-0.061)	(1.391)
Tobin's Q	-0.000	0.000	0.000	-0.001
	(-0.068)	(0.007)	(0.651)	(-0.306)
Return	0.001	0.003	-0.002	-0.004
	(0.933)	(1.358)	(-1.333)	(-0.906)
Capex	0.061***	0.192***	0.076***	0.214***
	(8.002)	(9.025)	(6.539)	(6.230)
Cash Flow	-0.009	-0.047**	0.007	-0.012
	(-1.258)	(-2.432)	(0.759)	(-0.446)
Sales Growth	-0.000	-0.002	0.002	-0.003
	(-0.135)	(-0.884)	(0.912)	(-0.412)
Constant	0.022**	0.038	0.005	-0.006
	(2.268)	(1.408)	(0.341)	(-0.129)
Observations	3,612	3,612	2,610	2,610
Adjusted R-squared	0.403	0.441	0.322	0.361
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Panel C: SA Index				
	Low Financial Constraints		High Financial Constraints	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
*Small Firm * EPU Beta*	0.037*	0.138**	0.017	0.014
	(1.880)	(2.399)	(0.726)	(0.214)
Small Firm	-0.001	-0.007	-0.005**	-0.008
	(-0.305)	(-1.151)	(-2.368)	(-1.560)
EPU Beta	0.008	0.013	0.006	0.022
	(0.601)	(0.319)	(0.468)	(0.616)
Leverage	-0.014**	-0.033**	-0.007	-0.002
	(-2.513)	(-2.028)	(-1.539)	(-0.131)
Firm Age	-0.029***	-0.072***	0.018	0.031
	(-4.590)	(-3.882)	(1.642)	(1.032)
ROA	-0.007	0.003	0.014	0.058**
	(-0.608)	(0.091)	(1.350)	(2.080)
Tobin's Q	-0.000	0.000	-0.000	-0.002
	(-0.461)	(0.007)	(-0.156)	(-1.226)
Return	-0.000	-0.001	0.000	0.002
	(-0.414)	(-0.410)	(0.256)	(0.730)
Capex	0.055***	0.175***	0.066***	0.206***
	(6.090)	(6.595)	(7.359)	(8.449)
Cash Flow	0.001	-0.023	-0.004	-0.039*
	(0.165)	(-1.014)	(-0.550)	(-1.903)
Sales Growth	0.002	0.002	-0.000	-0.007**
	(1.383)	(0.634)	(-0.295)	(-2.315)
Constant	0.034***	0.068**	-0.025	-0.038
	(3.208)	(2.210)	(-1.077)	(-0.598)
Observations	3,179	3,179	3,043	3,043
Adjusted R-squared	0.391	0.403	0.344	0.431
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 8. The impact of marketisation

This table presents the subsample analysis regarding the impact of marketisation, which is measured by Marketisation Index. Dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	Low Marketisation		High Marketisation	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
Small Firm EPU Beta*	0.059**	0.143**	0.016	0.064
	(2.396)	(2.038)	(0.988)	(1.394)
Small Firm	-0.008***	-0.027***	-0.001	-0.002
	(-3.512)	(-3.975)	(-0.382)	(-0.432)
EPU Beta	-0.007	-0.013	0.011	0.022
	(-0.453)	(-0.269)	(0.950)	(0.685)
Leverage	0.009*	0.043***	-0.014***	-0.024**
	(1.683)	(2.682)	(-3.583)	(-2.161)
Firm Age	-0.004	-0.007	-0.008*	-0.009
	(-0.524)	(-0.324)	(-1.829)	(-0.678)
ROA	0.012	0.047	-0.003	0.023
	(0.864)	(1.215)	(-0.368)	(0.944)
Tobin's Q	0.001	0.002	-0.001	-0.004**
	(0.957)	(0.913)	(-1.302)	(-2.505)
Return	-0.001	-0.003	0.000	0.003
	(-0.845)	(-0.839)	(0.482)	(0.975)
Capex	0.082***	0.241***	0.058***	0.181***
	(7.339)	(7.536)	(7.769)	(8.588)
Cash Flow	-0.005	-0.011	-0.001	-0.038**
	(-0.571)	(-0.418)	(-0.210)	(-2.063)
Sales Growth	-0.002	-0.010**	0.001	-0.002
	(-1.433)	(-2.568)	(1.070)	(-0.740)
Constant	0.011	0.022	0.026***	0.040
	(0.805)	(0.533)	(2.630)	(1.421)
Observations	1,611	1,611	4,611	4,611
Adjusted R-squared	0.376	0.431	0.354	0.403
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 9. The impact of ownership structure

This table presents the subsample analysis regarding the impact of ownership structure, which is identified according to the identity of a firm's ultimate controller. Dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	Non-SOE		SOE	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
Small Firm EPU Beta*	0.014	0.046	0.057**	0.117*
	(0.702)	(0.842)	(2.536)	(1.846)
Small Firm	-0.003	-0.010*	-0.004**	-0.011**
	(-1.382)	(-1.752)	(-2.258)	(-2.016)
EPU Beta	0.008	0.030	0.015	0.033
	(0.567)	(0.731)	(1.101)	(0.861)
Leverage	-0.016***	-0.038**	0.001	0.022*
	(-2.808)	(-2.295)	(0.217)	(1.835)
Firm Age	-0.009	-0.021	-0.007	-0.010
	(-1.234)	(-1.041)	(-1.345)	(-0.640)
ROA	0.000	0.019	0.014	0.070**
	(0.019)	(0.558)	(1.335)	(2.422)
Tobin's Q	0.000	-0.001	-0.000	-0.002
	(0.309)	(-0.567)	(-0.324)	(-0.832)
Return	-0.002	-0.003	0.000	0.001
	(-1.176)	(-0.910)	(0.153)	(0.501)
Capex	0.052***	0.186***	0.074***	0.210***
	(5.168)	(6.584)	(8.923)	(9.009)
Cash Flow	0.001	-0.019	-0.006	-0.037*
	(0.077)	(-0.738)	(-0.837)	(-1.936)
Sales Growth	0.002*	0.002	-0.001	-0.008***
	(1.862)	(0.425)	(-1.091)	(-2.786)
Constant	0.023*	0.049	0.023**	0.026
	(1.796)	(1.323)	(1.985)	(0.796)
Observations	2,791	2,791	3,431	3,431
Adjusted R-squared	0.360	0.381	0.333	0.413
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 10. The impact of industry properties

This table presents the subsample analysis regarding the impact of industry properties, including non-heavily polluting industries and heavily polluting industries. Dependent variable is corporate environmental investment, which is measured by *ENV/TA* $_{t+1}$ and *ENV/SA* $_{t+1}$. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	Non-Heavily Polluting		Heavily Polluting	
	(1)	(2)	(3)	(4)
Variables	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$	*ENV/TA* $_{t+1}$	*ENV/SA* $_{t+1}$
*Small Firm * EPU Beta*	0.035*	0.147**	0.007	-0.002
	(1.730)	(2.416)	(0.377)	(-0.049)
Small Firm	-0.004**	-0.017***	0.000	0.000
	(-2.062)	(-2.842)	(0.210)	(0.060)
EPU Beta	0.007	0.009	0.014	0.037
	(0.488)	(0.216)	(1.101)	(1.122)
Leverage	-0.024***	-0.044***	0.005	0.025**
	(-4.467)	(-2.811)	(1.109)	(2.238)
Firm Age	-0.003	-0.004	-0.009*	-0.014
	(-0.449)	(-0.240)	(-1.816)	(-1.021)
ROA	-0.007	0.025	0.017*	0.044
	(-0.592)	(0.745)	(1.674)	(1.631)
Tobin's Q	-0.001*	-0.006***	-0.000	0.001
	(-1.818)	(-2.859)	(-0.192)	(0.326)
Return	0.001	0.003	-0.001	-0.000
	(0.590)	(0.762)	(-0.547)	(-0.123)
Capex	0.080***	0.239***	0.048***	0.151***
	(8.066)	(8.134)	(6.007)	(7.063)
Cash Flow	0.006	-0.019	-0.008	-0.038**
	(0.744)	(-0.782)	(-1.182)	(-2.017)
Sales Growth	-0.001	-0.010***	0.001	0.000
	(-1.338)	(-2.977)	(1.297)	(0.062)
Constant	0.022*	0.053	0.013	0.002
	(1.878)	(1.512)	(1.236)	(0.057)
Observations	2,981	2,981	3,241	3,241
Adjusted R-squared	0.414	0.466	0.313	0.359
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Table 11. Environmental investment and bank loan

This table presents the regression results regarding environmental investment and bank loans. The Dependent variable is new-obtained bank loan in year *t*. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively. Variable definitions are summarised in Appendix C1.

	(1)	(2)
Variables	New Loan	New Loan
*Small Firm * ENV/TA*	4.591*	
	(1.952)	
*Small Firm * ENV/SA*		1.973***
		(2.754)
Small Firm	-0.579***	-0.600***
	(-4.821)	(-5.104)
ENV/TA	-1.672	
	(-1.320)	
ENV/SA		-0.606
		(-1.365)
Leverage	3.726***	3.756***
	(11.261)	(11.338)
Firm Age	0.176	0.148
	(0.476)	(0.399)
ROA	2.764***	2.768***
	(3.506)	(3.514)
Tobin's Q	-0.051	-0.043
	(-0.865)	(-0.727)
Return	-0.062	-0.062
	(-0.900)	(-0.908)
Capex	7.197***	7.162***
	(12.743)	(12.695)
Cash Flow	-5.628***	-5.646***
	(-10.393)	(-10.437)
Sales Growth	0.322***	0.324***
	(4.623)	(4.641)
Constant	15.879***	15.913***
	(22.531)	(22.601)
Observations	2,583	2,583
Adjusted R-squared	0.636	0.637
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Chapter Five
Conclusion

This chapter concludes the thesis and contains two sections. The first section briefly summarises the major findings from each of the three essays and discusses the implications of these findings. The second section discusses the potential areas for future research.

1. Major findings and implications

Overall, this thesis sheds light on different aspects of listed firms in the Chinese market, highlighting the government's significant influence as a shareholder, the impact of managerial political ties, and the consequences of policy uncertainties on firm behaviours.

Essay one reveals that state ownership has a nonlinear impact on firm performance. State ownership is negatively related to firm performance at lower levels before the threshold (e.g., 55% for ROA and 44% for Tobin's Q). However, beyond the threshold level, state ownership is positively associated with firm performance. Essay one also finds that introducing strategic investors diminishes the U-shaped association between state ownership and firm performance, implying that strategic investors may address the challenges associated with state ownership. Essay one illustrates the dynamic influence of state ownership on firm performance within a mixed-ownership environment, adding to the existing literature to better understand the complex nature of state ownership, particularly in the period when the concerns associated with the split-share structure have been addressed. It also contributes to the current body of knowledge by highlighting strategic investors' role in mitigating underperformance observed at the threshold levels of state ownership, which provides implications for policymakers seeking to enhance the effectiveness of the mixed-ownership structure.

Essay two finds that politically connected firms are associated with higher crack risk than firms without such political connections in the presence of campaign-style inspections.

Moreover, it reveals that the influence of political connections on crash risk is significant in firms where executives have achieved political connections, but insignificant in firms with executives having ascribed political connections. Essay two contributes to the literature by highlighting the risk profile of managerial political ties. While existing studies demonstrate that firms can obtain preferential treatment from the government by establishing political connections (Faccio, 2006; Fan et al., 2007; Khwaja & Mian, 2005), this study illustrates that politically connected firms may have more challenges concerning information disclosure when there is increased scrutiny. In addition, this essay offers insights for policymakers on the significance of addressing the influences associated with firm-level political connections to ensure the effective implementation of regulatory policies.

Essay three examines the relationship between EPU exposure, environmental investment, and firm size. It finds that small firms are associated with higher levels of environmental investment when exposed to greater levels of EPU than large firms. It also provides evidence that environmental investment positively correlates with the acquisition of new bank loans made by small firms, showing the possible benefit of engaging in environmental initiatives. Essay three extends the current knowledge by examining the link between EPU exposure and environmental investment, providing new evidence on how policy uncertainties influence corporate decision-making. It also sheds light on the importance of understanding firm-specific characteristics when examining the association between policy uncertainties and firm decision-making, which is in line with Ball et al. (2021). Overall, essay three provides insights to better understand the significant influences of policy uncertainties on corporate investment strategies.

2. Future areas of research

The essays contained in this thesis suggest several areas of research that might be pursued in the future. For example, the first essay in Chapter Two suggests the need for a more

detailed investigation into the specific role of strategic investors. Future research may explore the effects of different types of investments, investment horizons, and strategies employed by strategic investors on firm performance and how strategic investors influence state shareholders in detail. Understanding strategic investors' specific role can contribute to the effective design and promotion of the mixed-ownership structure. The final essay in Chapter Four indicates the importance of investigating the underlying reasons for employing environmental investment as a strategic decision in uncertain times. Future research can examine whether and how firms engage in environmental initiatives are supported by different mechanisms, such as the green credit policy. Previous literature suggests that small firms should adopt proactive strategies to seize opportunities in times of uncertainty (Cao et al., 2020; Clemens et al., 2008; Tarkom & Ujah, 2023). Gaining a more comprehensive understanding of the strategic decision-making of small firms will offer more practical implications for these firms in uncertain environments.

Appendix

Appendix A presents the variable definition, the additional test, and CGSS Questions for Essay One. Appendix B presents the variable definition for Essay Two. Appendix C presents the variable definition and additional test for Essay Three. Appendix D presents the statement of contribution for three essays.

Appendix A1: Variable definitions for Essay One

Variable	Definition
ROA	Ratio of net income to total assets.
Tobin's Q	Market value of equity, minus book value of equity, plus book value of assets, and divided by book value of total assets.
State Shares	Total percentage of shares held by the state in a firm.
Largest State Shares	The percentage of shares held by the single largest state shareholder among top 10 largest shareholders.
Block State Shares	The aggregated state ownership that is higher than 10%.
Foreign Shares	The percentage of shares held by foreign investors among top 10 shareholders.
Firm Size	Natural logarithm of the firm's total assets.
Firm Age	Natural logarithm of one plus the number of years the firm has been listed.
Leverage	Ratio of total debt to total assets.
CEO Age	The natural logarithm of the age of the CEO.
CEO Gender	Dummy variable equals one if the CEO is male and zero otherwise.
CEO Tenure	Natural logarithm of one plus the number of months the CEO has been in the current position.
CEO Duality	Dummy variable equals one if the CEO serves as the Chairman of the Board and zero otherwise.
Female Director	The percent of female directors on board.
Board Size	The natural logarithm of total number of directors on the board.
Board Independence	The proportion of independent directors on the board.
Provincial GDP Growth	Annual provincial GDP growth rate.
Earnings Management	The larger the value, the higher the degree of earnings management.
CGI	Corporate Governance Index as described in *Section 4.4.2.*
Govt. Intervention Score	Aggregated scores of answers to all three survey questions regarding government intervention from the CGSS.
Ln (Distance)	Natural logarithm of the distance in kilometres between the firm's registered headquarters and the stock exchange that the firm is listed.

Appendix A2: The impact of strategic investors on firm performance

This table presents the regression results adding the introduction of strategic investors as an additional control variable in Essay One. The dependent variable is firm performance, which is measured by *ROA* and *Tobin's Q*. *State Shares* is measured as the aggregated percentage of state shares among top 10 largest shareholders. Detailed variable definitions are summarised in Appendix A1. *t*-statistics are displayed in parentheses. ***, **, and * denote the significance levels at 1%, 5%, and 10%, respectively.

	(1)	(2)
Variables	*ROA*	*Tobin's Q*
State Shares	-0.129***	-3.005***
	(-5.878)	(-6.998)
State Shares^2	0.117***	3.430***
	(4.466)	(6.692)
Strategic Investors	0.006***	0.005
	(3.291)	(0.128)
Foreign Shares	0.040**	0.807**
	(2.303)	(2.396)
Firm Size	0.021***	-1.142***
	(16.059)	(-45.298)
Firm Age	0.002	-0.186***
	(0.744)	(-4.011)
Leverage	-0.204***	0.084
	(-43.648)	(0.920)
CEO Age	-0.006	0.222*
	(-0.993)	(1.790)
CEO Gender	-0.003	-0.093
	(-0.988)	(-1.378)
CEO Tenure	0.001*	-0.021*
	(1.924)	(-1.799)
Duality	0.002	-0.038
	(1.180)	(-1.092)
Female Director	-0.005	0.017
	(-0.698)	(0.114)
Board Size	0.005	0.188*
	(0.870)	(1.674)
Board Independence	-0.024	0.651**
	(-1.409)	(1.971)
Provincial GDP Growth	-0.010	0.461**
	(-0.877)	(2.085)
Constant	-0.266***	27.281***
	(-6.966)	(36.518)
Reflection Point (% of State Shares)	55.13%	43.80%
Observations	12,378	12,378
Adjusted R-squared	0.442	0.726
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Appendix A3: CGSS Questions

Appendix A3 lists the questions from CGSS used in Essay One.

Q1	If someone criticises the government in public places, the government should not interfere. Do you agree?	
	Options	Score
	Totally disagree	1
	Somewhat disagree	2
	Neither agree or disagree	3
	Somewhat agree	4
	Totally Agree	5
Q2	How many children a person has is a personal matter, the government should not interfere. Do you agree?	
	Options	Score
	Totally disagree	1
	Somewhat disagree	2
	Neither agree or disagree	3
	Somewhat agree	4
	Totally Agree	5
Q3	Where to work and live is a personal matter, the government should not interfere. Do you agree?	
	Options	Score
	Totally disagree	1
	Somewhat disagree	2
	Neither agree or disagree	3
	Somewhat agree	4
	Totally Agree	5

Appendix A4: Refined Sample Excluding Regulated Industries

Appendix A4 presents results using a refined sample excluding highly regulated industries. Panel A refers to the full sample. Panel B refers to the subsample analysis concerning strategic investors.

Panel A: The U-shaped relationship excluding regulated industries

	(1)	(2)
Variables	*ROA*	*Tobin's Q*
State Shares	-0.103***	-2.953***
	(-4.685)	(-6.904)
State Shares^2	0.086***	3.287***
	(3.142)	(6.182)
Foreign Shares	0.043**	0.916***
	(2.452)	(2.691)
Firm Size	0.022***	-1.091***
	(16.261)	(-41.172)
Firm Age	0.002	-0.149***
	(0.954)	(-3.133)
Leverage	-0.205***	-0.082
	(-41.561)	(-0.861)
CEO Age	-0.001	0.232*
	(-0.223)	(1.826)
CEO Gender	-0.006*	-0.061
	(-1.723)	(-0.882)
CEO Tenure	0.001**	-0.016
	(2.036)	(-1.347)
Duality	-0.000	-0.086**
	(-0.185)	(-2.401)
Female Director	-0.004	-0.101
	(-0.478)	(-0.667)
Board Size	0.005	0.176
	(0.779)	(1.502)
Board Independence	-0.015	0.419
	(-0.879)	(1.237)
Provincial GDP Growth	-0.006	0.476**
	(-0.537)	(2.100)
Constant	-0.322***	26.206***
	(-8.045)	(33.819)
Reflection Point (% of State Shares)	59.88%	44.92%
Observations	11,097	11,097
Adjusted R-squared	0.451	0.730
Firm-fixed effects	Yes	Yes
Year-fixed effects	Yes	Yes

Panel B: The impact of strategic investors excluding regulated industries

	Strategic Investors = 0		Strategic Investors = 1	
	(1)	(2)	(3)	(4)
Variables	*ROA*	*Tobin's Q*	*ROA*	*Tobin's Q*
State Shares	-0.108***	-2.596***	-0.001	-1.353

	(-3.614)	(-4.398)	(-0.012)	(-1.112)
State Shares^2	0.098**	3.343***	-0.013	1.530
	(2.204)	(3.800)	(-0.180)	(1.243)
Foreign Shares	0.071***	0.465	-0.053	4.363***
	(3.243)	(1.066)	(-1.241)	(6.085)
Firm Size	0.030***	-1.254***	0.023***	-0.783***
	(16.394)	(-34.639)	(8.135)	(-16.572)
Firm Age	0.012***	-0.077	-0.009	-0.250*
	(3.692)	(-1.227)	(-1.136)	(-1.853)
Leverage	-0.221***	-0.283**	-0.213***	0.173
	(-33.853)	(-2.184)	(-21.857)	(1.063)
CEO Age	0.003	0.302*	-0.020	0.180
	(0.325)	(1.768)	(-1.629)	(0.881)
CEO Gender	-0.009*	-0.196**	-0.002	-0.129
	(-1.892)	(-2.047)	(-0.354)	(-1.194)
CEO Tenure	0.001	-0.026	0.001	0.013
	(1.480)	(-1.602)	(0.822)	(0.820)
Duality	-0.003	-0.140***	0.001	-0.035
	(-1.013)	(-2.826)	(0.294)	(-0.705)
Female Director	0.001	-0.065	-0.004	-0.079
	(0.074)	(-0.297)	(-0.286)	(-0.355)
Board Size	0.012	0.495***	0.013	-0.016
	(1.394)	(2.942)	(1.299)	(-0.096)
Board Independence	0.025	0.824	-0.044	-0.670
	(0.978)	(1.635)	(-1.600)	(-1.470)
Provincial GDP Growth	-0.017	0.299	-0.003	0.208
	(-0.955)	(0.828)	(-0.204)	(0.805)
Constant	-0.542***	28.573***	-0.270***	19.555***
	(-10.023)	(26.710)	(-3.345)	(14.493)
Reflection Point (% of State Shares)	55.10%	38.83%	n/a	n/a
Observations	7,510	7,510	3,587	3,587
Adjusted R-squared	0.453	0.740	0.509	0.736
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Appendix A5: The detailed results showing how findings evolve

This table presents the full regression results adding different control variables gradually. Panel A corresponds to the main results as reported in Table 4. Panel B corresponds to the results as reported in Table 8. Panel C corresponds to the results as reported in Table 9.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	*ROA*	*ROA*	*ROA*	*ROA*	*ROA*	*Tobin's Q*	*Tobin's Q*	*Tobin's Q*	*Tobin's Q*	*Tobin's Q*
State Shares	-0.036***	-0.146***	-0.112***	-0.114***	-0.114***	-0.406**	-2.062***	-2.969***	-2.981***	-2.993***
	(-4.080)	(-6.256)	(-5.213)	(-5.314)	(-5.301)	(-2.344)	(-4.515)	(-7.101)	(-7.104)	(-7.132)
State Shares^2		0.170***	0.101***	0.103***	0.103***		0.810	3.403***	3.408***	3.419***
		(6.059)	(3.910)	(3.981)	(3.971)		(1.471)	(6.743)	(6.742)	(6.765)
Foreign Shares	0.047***		0.044**	0.043**	0.043**	0.950***		0.838**	0.796**	0.810**
	(2.729)		(2.554)	(2.500)	(2.482)	(2.821)		(2.494)	(2.366)	(2.406)
Firm Size	0.021***		0.021***	0.021***	0.021***	-1.121***		-1.133***	-1.140***	-1.142***
	(16.592)		(16.248)	(15.976)	(16.000)	(-44.722)		(-45.403)	(-45.254)	(-45.308)
Firm Age	0.001		0.001	0.001	0.001	-0.188***		-0.189***	-0.186***	-0.187***
	(0.387)		(0.396)	(0.394)	(0.404)	(-4.067)		(-4.131)	(-4.024)	(-4.047)
Leverage	-0.205***		-0.204***	-0.204***	-0.204***	0.064		0.079	0.085	0.084
	(-43.853)		(-43.744)	(-43.745)	(-43.739)	(0.704)		(0.867)	(0.928)	(0.917)
CEO Age	-0.007			-0.006	-0.006	0.216*			0.220*	0.222*
	(-1.030)			(-0.997)	(-1.002)	(1.738)			(1.776)	(1.789)
CEO Gender	-0.004			-0.004	-0.004	-0.101			-0.095	-0.093
	(-1.112)			(-1.022)	(-1.037)	(-1.506)			(-1.414)	(-1.380)
CEO Tenure	0.001*			0.001*	0.001*	-0.021*			-0.021*	-0.021*
	(1.881)			(1.904)	(1.906)	(-1.837)			(-1.795)	(-1.799)
Duality	0.002			0.002	0.002	-0.034			-0.039	-0.038
	(1.254)			(1.190)	(1.183)	(-0.967)			(-1.109)	(-1.092)
Female Director	-0.006			-0.006	-0.006	0.012			0.016	0.017
	(-0.767)			(-0.747)	(-0.749)	(0.080)			(0.107)	(0.112)
Board Size	0.004			0.005	0.005	0.158			0.188*	0.188*
	(0.687)			(0.844)	(0.844)	(1.404)			(1.672)	(1.674)
Board Independence	-0.023			-0.024	-0.024	0.679**			0.647*	0.651**

	(-1.367)			(-1.413)	(-1.418)	(2.051)			(1.960)	(1.971)
Provincial GDP Growth	-0.011				-0.010	0.444**				0.460**
	(-0.969)				(-0.925)	(2.005)				(2.084)
Constant	-0.284***	0.068***	-0.293***	-0.267***	-0.265***	26.657***	3.744***	28.537***	27.332***	27.282***
	(-7.480)	(16.708)	(-10.640)	(-6.970)	(-6.937)	(35.884)	(47.235)	(53.029)	(36.602)	(36.522)
Reflection Point (% of State Shares)	n/a	42.94%	55.45%	55.34%	55.34%	n/a	n/a	43.62%	43.74%	43.77%
Observations	12,378	12,378	12,378	12,378	12,378	12,378	12,378	12,378	12,378	12,378
Adjusted R-squared	0.440	0.328	0.441	0.441	0.441	0.725	0.668	0.726	0.726	0.726
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B

Variables	(1) *Earnings Management*	(2) *Earnings Management*	(3) *Earnings Management*	(4) *Earnings Management*
State Shares	0.213***	0.228***	0.220***	0.219***
	(3.503)	(3.752)	(3.595)	(3.580)
State Shares^2	-0.205***	-0.255***	-0.248***	-0.247***
	(-2.802)	(-3.467)	(-3.371)	(-3.359)
Foreign Shares		0.039	0.033	0.034
		(0.794)	(0.681)	(0.702)
Firm Size		0.022***	0.021***	0.021***
		(5.942)	(5.684)	(5.636)
Firm Age		-0.019***	-0.020***	-0.020***
		(-2.891)	(-2.963)	(-2.974)
Leverage		0.097***	0.098***	0.098***
		(7.360)	(7.383)	(7.377)
CEO Age			0.000	0.000
			(0.014)	(0.020)
CEO Gender			-0.012	-0.012
			(-1.203)	(-1.185)
CEO Tenure			0.000	0.000
			(0.103)	(0.100)
Duality			-0.011**	-0.010**
			(-2.060)	(-2.052)
Female Director			-0.001	-0.001
			(-0.053)	(-0.051)
Board Size			0.022	0.022
			(1.330)	(1.330)
Board Independence			0.010	0.010
			(0.208)	(0.214)
Provincial GDP Growth				0.034
				(1.068)
Constant	-0.042***	-0.519***	-0.539***	-0.543***
	(-3.958)	(-6.624)	(-4.962)	(-4.994)
Reflection Point (% of State Shares)	51.95%	44.71%	44.35%	44.33%
Observations	12,378	12,378	12,378	12,378
Adjusted R-squared	0.406	0.412	0.412	0.412
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Panel C

Variables	(1) *CGI*	(2) *CGI*	(3) *CGI*	(4) *CGI*
State Shares	-17.149***	-13.458***	-9.401***	-9.457***
	(-7.684)	(-6.305)	(-4.517)	(-4.544)
State Shares^2	29.666***	19.856***	16.570***	16.625***
	(11.032)	(7.707)	(6.609)	(6.631)
Foreign Shares		6.254***	7.836***	7.900***
		(3.644)	(4.695)	(4.732)
Firm Size		3.513***	3.804***	3.795***
		(27.566)	(30.469)	(30.370)
Firm Age		-3.082***	-3.291***	-3.296***
		(-13.174)	(-14.382)	(-14.404)
Leverage		-7.258***	-7.368***	-7.373***
		(-15.614)	(-16.306)	(-16.320)
CEO Age			1.510**	1.518**
			(2.453)	(2.466)
CEO Gender			0.135	0.145
			(0.404)	(0.436)
CEO Tenure			0.217***	0.217***
			(3.812)	(3.809)
Duality			1.030***	1.033***
			(5.926)	(5.943)
Female Director			-1.298*	-1.295*
			(-1.769)	(-1.765)
Board Size			-11.353***	-11.355***
			(-23.317)	(-23.325)
Provincial GDP Growth				2.150**
				(1.962)
Constant	51.262***	-15.966***	-4.401	-4.625
	(132.324)	(-5.812)	(-1.244)	(-1.307)
Reflection Point (% of State Shares)	28.90%	33.89%	28.37%	28.44%
Observations	12,378	12,378	12,378	12,378
Adjusted R-squared	0.720	0.748	0.762	0.762
Firm-fixed effects	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes

Appendix B: Variable definitions for Essay Two

Variable	Definition
Dependent variable	
NCSKEW	The negative skewness of firm-specific weekly returns, which is the negative of the third moment of firm-specific weekly returns for each sample year and divided by the standard deviation of firm-specific weekly returns raised to the third power. See Equation (3) for details.
DUVOL	The down-to-up volatility, which is the natural logarithm of the ratio of the standard deviation of firm-specific weekly returns in down weeks to the standard deviation of firm-specific weekly returns in up weeks. See Equation (4) for details.
Main independent variables	
Inspection	Dummy variable equals one if firm *i* is headquartered in a province that is inspected in year t and thereafter, and zero otherwise.
PC	Dummy variable equals one if the CEO or chairperson has past or current government working experience or political appointments to the People's Congress or the CPPCC, and zero otherwise.
Achieved PC	Dummy variable equals one if the CEO or chairperson of firm *i* has served or is currently serving as the deputy of the People's Congress or member of Chinese People's Political Consultative Conference but has no government working experience, and zero otherwise.
Ascribed PC	Dummy variable equals one if a firm's CEO or chairperson has only past or current government working experience, and zero otherwise.
Firm-level control variables	
Dturn	The detrended share turnover, which is calculated as the difference in average monthly share turnover between current and the previous year, where monthly share turnover is the monthly trading volume divided by the number of shares outstanding.
RET	The average firm-specific weekly return over the fiscal year.
Sigma	The standard deviation of firm-specific weekly returns over the fiscal year.
BM Ratio	The ratio of the firm's book to market value.
ABACC	The absolute value of discretionary accruals.
ROA	Ratio of net income to total assets.
Firm Size	Natural logarithm of the firm's total assets.
Leverage	Ratio of total debt to total assets.
State Ownership	Percentage of total state shares owned by the top 10 largest shareholders.
Largest	Percentage of shares owned by the largest shareholders.
Environmental Governance	Provincial investment of industrial pollution control adjusted by the secondary industry added value.
Misconduct Cases	The total number of environmental misconduct cases in each province.
SOE	Dummy variable equals one if a firm is ultimately controlled by state, and zero otherwise.
Information Asymmetry	The annual average of the monthly dispersion of analysts' forecasts of earnings per share.
Heavy Polluter	Dummy variable equals one if a firm is listed on the environmental monitoring list, and zero otherwise.
Official Turnover	Dummy variable equals one if there is an official turnover in the current year, and zero otherwise.
AMEs	Abnormal management expenses as described in *Section 4.4.6.*

Appendix C1: Variable definitions for Essay Three

Variable	Definition
Dependent variable	
ENV/TA $_{t+1}$	A firm's environmental investment scaled by its total assets in year *t+1*.
ENV/SA $_{t+1}$	A firm's environmental investment scaled by its total sales revenue in year *t+1*.
Adj. ENV/TA $_{t+1}$	Industry-adjusted *ENV/TA* in year *t+1*.
Adj. ENV/SA $_{t+1}$	Industry-adjusted *ENV/SA* in year *t+1*.
Independent variables	
Small Firm	Dummy variable equals one if firm *i*'s total assets in year *t* is lower than the median level in the same industry, and zero otherwise.
Alt Small Firm	Dummy variable that equals one if firm *i*'s total employee in year *t* is lower than 2,000, and zero otherwise.
EPU Beta	Firm sensitivity to EPU estimated using China's EPU Index and China's Fama-French three factors over the past 60-month window. See *Section 3.2.2* for details.
EPU Beta 36	Firm sensitivity to EPU estimated using China's EPU Index and China's Fama-French three factors over the past 36-month window. See *Section 4.3.1* for details.
EPU Beta FF	Firm sensitivity to EPU estimated using China's EPU Index and China's Fama-French five factors over the past 60-month window. See *Section 4.3.1* for details.
EPU Beta Clean	Firm sensitivity to EPU after extracting the component of the China's EPU index orthogonal to the EPU index of the U.S. See *Section 4.3.1* for details.
Leverage	Ratio of total debt to total assets.
Firm Age	The natural logarithm of the number of years a firm has been established.
ROA	Ratio of net income to total assets.
Tobin's Q	The ratio of the total market value of equity to the total book value of assets at the end of each year.
Return	A firm's annual stock return.
Capex	The capital expenditure scaled by total assets.
Cash Flow	The ratio of cash flow from operations to total assets.
Sales Growth	The annual growth rate in revenues.
Financial Constraints	FC index is constructed as the probability (*P*) of financing constraints occurring for each year of the firm. WW index and SA index are two alternative measures of financial constraints. See *Section 4.4.1* for details.
Marketisation Index	Marketisation Index developed by Wang et al. (2021).
SOE	Dummy variable equals one if a firm is ultimately controlled by state, and zero otherwise.
Heavily Polluting Industries	Dummy variable equals one if for firms in heavily polluting industries, and zero otherwise.
New Loan	Natural logarithm of new-obtained bank loan amount for the firm in year *t.*

Appendix C2: Analysis concerning different components of environmental initiatives

Appendix C2 presents results using different components of environmental initiatives as the dependent variable. *Green* refers to projects that are related to ecological protection. *Energy* refers to projects that are related to new and/or clean energy. *Waste* refers to projects that reduce wasted water, gas, solid and related waste treatment and management. *Air* refers to projects that improve air quality.

Variables	(1) *Green/TA* $_{t+1}$	(2) *Energy/TA* $_{t+1}$	(3) *Waste/TA* $_{t+1}$	(4) *Air/TA* $_{t+1}$	(5) *Green/SA* $_{t+1}$	(6) *Energy/SA* $_{t+1}$	(7) *Waste/SA* $_{t+1}$	(8) *Air/SA* $_{t+1}$
Small Firm * EPU Beta	0.012	0.083***	-0.002	0.007	0.045	0.278***	0.011	0.022
	(0.739)	(2.626)	(-0.176)	(0.280)	(1.356)	(3.163)	(0.239)	(0.375)
Small Firm	0.003	-0.009***	0.002	-0.000	0.004	-0.025***	0.007	-0.001
	(1.621)	(-2.621)	(1.299)	(-0.242)	(0.925)	(-2.734)	(1.306)	(-0.274)
EPU Beta	0.003	0.009	-0.004	-0.012	-0.007	0.012	-0.014	-0.052*
	(0.272)	(0.463)	(-0.433)	(-0.909)	(-0.320)	(0.215)	(-0.452)	(-1.694)
Leverage	-0.016***	0.005	-0.000	-0.013***	-0.037***	0.049**	0.001	-0.037***
	(-3.596)	(0.663)	(-0.138)	(-3.558)	(-4.026)	(2.213)	(0.062)	(-4.468)
Firm Age	-0.004	-0.022**	-0.003	-0.004	0.003	-0.036	0.002	-0.007
	(-0.775)	(-2.132)	(-0.802)	(-0.719)	(0.290)	(-1.279)	(0.156)	(-0.509)
ROA	0.003	0.017	0.002	0.013	-0.011	0.097*	0.015	0.036
	(0.294)	(0.791)	(0.239)	(1.181)	(-0.482)	(1.657)	(0.515)	(1.426)
Tobin's Q	-0.000	0.001	-0.001**	0.001	-0.001	0.002	-0.006***	0.003*
	(-0.633)	(0.551)	(-2.548)	(1.450)	(-0.974)	(0.456)	(-3.524)	(1.659)
Return	-0.002**	0.001	0.001	0.000	-0.002	0.001	0.003	-0.000
	(-2.064)	(0.478)	(1.622)	(0.134)	(-1.323)	(0.229)	(1.202)	(-0.182)
Capex	0.026***	0.088***	0.026***	0.012*	0.071***	0.303***	0.098***	0.042**
	(3.321)	(6.269)	(4.349)	(1.706)	(4.495)	(7.781)	(4.746)	(2.497)
Cash Flow	0.001	-0.013	-0.002	-0.010	0.002	-0.069*	-0.014	-0.029*
	(0.179)	(-0.970)	(-0.478)	(-1.512)	(0.157)	(-1.889)	(-0.818)	(-1.906)
Sales Growth	-0.001	0.000	0.000	-0.002	-0.004*	-0.007	0.000	-0.003
	(-0.749)	(0.070)	(0.181)	(-1.609)	(-1.845)	(-1.522)	(0.002)	(-1.228)
Constant	0.018*	0.012	0.011	0.014	0.025	-0.026	0.012	0.033
	(1.784)	(0.548)	(1.436)	(1.356)	(1.204)	(-0.435)	(0.449)	(1.414)

Observations	1,752	1,977	1,818	610	1,752	1,977	1,818	610
Adjusted R-squared	0.400	0.299	0.485	0.314	0.455	0.366	0.535	0.386
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix D: Statement of Contribution

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION
DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.

Student name:	Shuai Yue
Name and title of main supervisor:	Professor Hamish Anderson
In which chapter is the manuscript/published work?	Chapter Two
What percentage of the manuscript/published work was contributed by the student?	Student: Shuai Yue 70%, and members of the supervisory team: Hamish Anderson 15% and Jing

Describe the contribution that the student has made to the manuscript/published work:

The candidate initiated research questions, collected the research data, constructed all the empirical analyses, and drafted the manuscript. The candidate will revise and update the manuscript for journal submission after receiving supervisors' suggestions and guidance.

Please select one of the following three options:

- ○ The manuscript/published work is published or in press
  Please provide the full reference of the research output:
- ○ The manuscript is currently under review for publication
  Please provide the name of the journal:
- ◉ It is intended that the manuscript will be published, but it has not yet been submitted to a journal

Student's signature:	Shuai Yue Digitally signed by Shuai Yue Date: 2023.07.23 20:53:10 +12'00'	Main supervisor's signature:	Hamish Anderson Digitally signed by Hamish Anderson DN: cn=Hamish Anderson, c=NZ, o=Massey University, ou=School of Economics & Finance, email=h.d.anderson@massey.ac.nz Date: 2023.07.24 10:14:34 +12'00'

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We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.

Student name:	Shuai Yue
Name and title of main supervisor:	Professor Hamish Anderson
In which chapter is the manuscript/published work?	Chapter Three
What percentage of the manuscript/published work was contributed by the student?	Student: Shuai Yue 70%, and members of the supervisory team: Hamish Anderson 15% and Jing

Describe the contribution that the student has made to the manuscript/published work:

The candidate initiated research questions, collected the research data, constructed all the empirical analyses, and drafted the manuscript. The candidate will revise and update the manuscript for journal submission after receiving supervisors' suggestions and guidance.

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- ○ The manuscript is currently under review for publication
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Student's signature:	Shuai Yue Digitally signed by Shuai Yue Date: 2023.07.23 20:54:16 +12'00'	Main supervisor's signature:	Hamish Anderson Digitally signed by Hamish Anderson DN: cn=Hamish Anderson, c=NZ, o=Massey University, ou=School of Economics & Finance, email=h.d.anderson@massey.ac.nz Date: 2023.07.24 10:14:54 +12'00'

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We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.

Student name:	Shuai Yue
Name and title of main supervisor:	Professor Hamish Anderson
In which chapter is the manuscript/published work?	Chapter Four
What percentage of the manuscript/published work was contributed by the student?	Student: Shuai Yue 70%, and members of the supervisory team: Hamish Anderson 15% and Jing

Describe the contribution that the student has made to the manuscript/published work:

The candidate initiated research questions, collected the research data, constructed all the empirical analyses, and drafted the manuscript. The candidate will revise and update the manuscript for journal submission after receiving supervisors' suggestions and guidance.

Please select one of the following three options:

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- ○ The manuscript is currently under review for publication
  Please provide the name of the journal:
- ◉ It is intended that the manuscript will be published, but it has not yet been submitted to a journal

Student's signature:	Shuai Yue Digitally signed by Shuai Yue Date: 2023.07.23 20:55:22 +12'00'	Main supervisor's signature:	Hamish Anderson Digitally signed by Hamish Anderson DN: cn=Hamish Anderson, c=NZ, o=Massey University, ou=School of Economics & Finance, email=h.d.anderson@massey.ac.nz Date: 2023.07.24 10:15:05 +12'00'

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References

The final section of this thesis contains all the references referred to in the thesis. Each essay was produced as a standalone paper. Therefore, the references for each paper (Chapters Two to Four) plus Chapters One and Five are reproduced here and are shown by chapter.

Introduction

Chapter One

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Conclusion

Chapter Five

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