Three Essays in Corporate Finance

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by

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A Thesis Submitted for the Degree of Doctor of Philosophy in Finance

Durham University Business School

Durham University

Oct 2022

Abstract

This dissertation, consisting of three essays, contributes to corporate finance in relation to corporate value creation. I explore three major areas: (1) corporate cash holding, (2) merger and acquisition (M&A) and innovation, and (3) ESG.

The first essay empirically examines the impact of managers' belief in luck on firms' cash holding and the implications that this has for corporate value in Chinese listed firms. By proposing an individual's zodiac year as a proxy for shock to one's perception of luck, the research finds that corporate cash holding temporarily rises in the zodiac year of the chairperson due to a belief in bad luck related to their zodiac. The rise of cash reserves is inefficient and suboptimal for the firm's value. The results provide support for the behavioural explanation of corporate structure choice and corporate value.

The second essay explores the impact of state ownership on post-M&A innovation performance. The study demonstrates that state-owned acquirers (SOAs) invest more in research and development (R&D) and generate more patents following M&A than their private-owned counterparts, and that the increase in R&D investment following M&A is more likely to occur in SOAs that are oriented toward responsible innovation, whereas the increase in patent counts following M&A is frequently observed in other SOAs. These findings indicate that state ownership in China drives acquirers' post-M&A innovation, and that responsible innovation orientation distinguishes R&D investment and patent publishing growth trends.

The third essay investigates the financial benefit of firm's environmental, social, and governance (ESG) efforts in the context of M&A in China. I discover a positive correlation between firms' ESG rating prior to M&A and their subsequent stock and operational performance. I also demonstrate that for acquirers with high initial ESG standards, an increase in ESG rating has little effect on post-M&A performance, whereas a decrease in ESG rating can result in significant poor performance. Meanwhile, for acquirers with relatively low initial

ESG standards, I observe a mirror image of this. These findings corroborate the instrumental stakeholder theory and the law of declining marginal value.

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Abbreviations

2SLS: 2-stage-least square

CEO: chief executive officer

CSMAR: China Stock Market Accounting Database

CSR: corporate social responsibility

CSRC: China Security Regulatory Commission

DMU: diminishing marginal utility

ESG: environment, society, governance

M&A: merger and acquisition

OLS: ordinary least square

POA(s): private-owned acquirer (s)

POE(s): private-owned enterprises (s)

PSM: propensity score matching

R&D: research and development

RIOSOE (s): responsible-innovation-oriented state-owned enterprise (s)

RMB: Renminbi

SOA(s): state-owned acquirer (s)

SOE(s): state-owned enterprises (s)

Declaration

The content of this doctoral dissertation is based on research work completed at Durham University Business School, UK. No material contained in the thesis has previously been submitted for a degree at this or any other university.

Statement of Copyright

Acknowledgement

During the completion of this dissertation, I received exceptional support from numerous people, to whom I am truly thankful. First and foremost, I would like to express my gratitude to my supervisor, Prof. Dr. Michael Guo, for allowing me to write this thesis. Starting with the day he hired me as a PhD candidate, Michael was always generous with his time and patience in guiding me through this process. I am sincerely appreciative of his consistent support and valuable advice. In this regard, I would also like to thank my colleagues and friends from the economics and finance department of the Durham business school for their many fruitful interactions and insightful comments.

This thesis benefited substantially from the support that I received from Prof. Dr. Ke Tang and Dr. Nan Hu and which led to the essay in chapter 2 of this thesis. It was a pleasure to work with them. Moreover, I am very grateful for the pleasant collaboration with Prof. Dr. Li Ding and Dr. Xi Li which led to the essay in chapter 3 of this dissertation. Their splendid advice, high standards for research, and infinite enthusiasm were a great impetus and made me surpass myself.

I would like to give special thanks to the Chinese Scholar Council (CSC) which generously supported the development of my personal and academic career with several scholarships as well as financial grants for conference attendances and my stay in the UK.

Last but not least, I am indebted to my family. I would like to express my deepest gratitude to my parents, Yuntian LI and Yuanguan LI, for their unconditional love, commitment, and support in this endeavour. In this regard, I would also like to thank Erlong Niu for his continuous support, his insightful counsel, his faith in me, and for always making me smile. I am extremely grateful to have him in my life.

Chapter 1: Introduction

Managers can maximize firm value by choosing the optimal corporate cash holding level and value-enhancing investment project. In terms of corporate cash holding, the literature demonstrates that firms hold a reasonable proportion of their assets as cash and cash equivalents as a precaution as well as to prevent underinvestment costs (Keynes 1936), but shareholders should be concerned that CEOs holding excessive amounts of cash may distort overall firm value due to agency cost and opportunity cost (Jensen 1986; Harford 1999). Since corporate cash holdings have benefits and costs for the firm, an optimum cash level, at which the value of the firm is maximized, may have to be determined.

Corporate investment activities are also related to firm value, given that investments generate returns but also cause uncertainty and risk the possibility of failure. For example, merger and acquisition (M&A) is a form of investment project that, in theory, creates synergies, builds economies of scale, expands operations, and reduces costs (Ismail *et al*. 2011); however, empirical studies have documented that many mergers destroy firm value, particularly for acquirers in the short term (Dodd 1980; Mitchell & Lehn 1990; Campa & Hernando 2004). In addition, innovation is considered to be one of the most important drivers of firms' long-term economic growth and competitive advantage (Solow 1957; Romer 1987; Hall *et al.* 2005), although it should also be acknowledged that innovative projects are risky, expensive, and time-consuming (Dai *et al.* 2021). Another type of corporate investment related to corporate social responsibility (CSR) and ESG influences the value of a company as it may increase the firm's legitimacy and social capital by catering to stakeholders with money from shareholders (Deng *et al.* 2013; Lins *et al.* 2017).

In this dissertation, I contribute to the literature on corporate value creation by writing three essays on the aforementioned topics: cash holdings, M&A and innovation, and ESG. The first essay draws on the cognitive bias of corporate managers and attempts to explore the impact of managers' belief in luck on corporate cash holding decisions, as well as its implications for

firm value by analysing cash's value. Focusing on long-term value creation through M&A, the second essay then examines the significance of state ownership and responsible orientation for post-M&A innovation performance. Finally, the third essay focuses on the firm value creation associated with CSR efforts in the context of M&A.

In Chapter 2, I examine the effect of CEOs' belief in luck on corporate cash holdings and value. My interest in this area is motivated by a growing body of research demonstrating that managers' traits and personal preferences lead to heterogeneous managerial decisions across otherwise identical firms (see Malmendier & Tate 2005, 2008; Malmendier *et al*. 2011; Hutton *et al.* 2014; Adhikari & Agrawal 2016a, b). I then test the impact of managers' cognitive bias on corporate cash holdings and firm value, based on the precautionary motive of corporate cash reserves.

Precaution is one of the most important reasons for holding cash (Keynes 1936; Opler *et al*. 1999). Cash provides a cushion against bankruptcy risks and protects against negative cash flow shocks by allowing firms to finance their activities in the absence of other sources of financing. Consistent with this perspective, Bates *et al.* (2009) find that the increase in cash reserves over time is positively correlated with the rise in firm-specific risks. However, cash (and cash equivalents) are negative net present value projects because the rates of return on cash and marketable securities are typically much lower than the required rates of return for investors. Given that holding cash involves such risk-return trade-offs, it is plausible that managers' risk perception affects the amount of cash a firm holds.

Belief in luck is directly related to one's risk perception. According to the illusion of control theory (Langer 1975; Wohl & Enzle 2002), belief in bad or good luck will make individuals either underestimate or overestimate their control over what might otherwise be considered fortuitous events. Hence, there may be a tendency to either overestimate or underestimate the probability of a negative outcome from an uncertain event, even though its actual probability

remains unchanged. Thus, if firm managers believe in bad (or good) luck, their perception of risk may be higher (or lower) than the actual risk.

To empirically test the notion that managers believe in luck, I use Chinese zodiac year as proxy for a shock to managers' perceived luck. The culture surrounding the Chinese zodiac year (Ben Ming Nian) is well suited for my purposes, since an individual's zodiac year is widely believed to influence one's bad luck – that is, individuals entering their zodiac year are expected to experience bad luck, including the loss of money, relationship difficulties, and career challenges. In addition, zodiac years can be considered exogenous to both firms and individual managers, since they occur cyclically every 12 years based upon the individual's birth year, meaning that one-twelfth of the population will be in their zodiac year. Hence, variations in corporate policies observed around a manager's zodiac year cannot easily be attributed to unobserved heterogeneity or reverse causality.

By analysing the responses of Chinese public firm chairpersons to their perceptions of bad luck pertaining to the Chinese zodiac year, I find that these perceptions of bad luck increase managers' sense of risk and lead them to increase their corporate cash holdings, even though the actual underlying risk remains unchanged. The effect is temporary and begins at the end of the quarter prior to the commencement of the zodiac year. When the zodiac year has passed, the level of risk perceived decreases and the bias disappears. The distortion between perceived and actual risk is significant, and the increase in cash holdings is both suboptimal and inefficient to firm value, in my view. Overall, these managerial reactions to the zodiac year are consistent with theories regarding belief in luck.

The empirical research presented in Chapter 2 makes multiple contributions. First, it contributes to the literature on cognitive bias in management and corporate activity by investigating CEOs' belief in luck. In addition, it makes significant contributions to the literature on corporate cash holdings by demonstrating that the chairperson's belief in luck, a form of cognitive bias, has a substantial impact on the average value of cash holdings.

After that, Chapter 3 examines the effect of state ownership on a firm's innovation performance following M&A, taking into account the heterogeneity of the firm's innovation orientation (i.e. the responsible innovation orientation). This research draws from two types of literature. One includes the literature on M&A and firm innovation performance (Cassiman *et al*. 2005; Cloodt *et al.* 2006; Choi & Sethi 2010; Bena & Li 2014; McCarthy & Aalbers 2016; Cefis & Marsili 2019), while the other contains literature investigating the role of state ownership on firm performance, including M&A (Zhou *et al*. 2015).

A firm can improve its capacity for innovation through a combination of knowledge-enhancing investments and the acquisition of external knowledge bases (Cohen & Levinthal 1989; Huber 1991; Ahuja & Katila 2001). M&A is viewed as a means for a company to acquire external knowledge for innovation purposes (Cassiman *et al.* 2005; Choi & Krause 2006; Cloodt *et al.* 2006; Bena & Li 2014; McCarthy & Aalbers 2016; Cefis & Marsili 2019). However, since M&A transactions are complex and risky (Sherman 2010; Poniachek 2019), it is uncertain whether they result in innovation synergy. The literature suggests that the success of mergers and acquisitions involving innovation may be influenced by the acquirer's resources, capacity for integration, and innovation orientation.[1]

State ownership has significant impacts on firm value, especially in emerging markets such as China (Megginson & Netter 2001). Some argue that state-owned firms have less profitability and lower market valuation (Chen *et al.* 2017), while Calomiris *et al.* (2010), among others, find a positive relation between state ownership and firm value. However, studies such as those

[1] Factors related to the acquirers' resources include acquirers' financial constraint, policy support, and tax support, etc. (Desyllas & Hughes 2010; Yang et al. 2019). Factors related to the capacity to integrate include technological similarity, resource complementarity, and stakeholder orientation (Ahuja & Katila 2001; Cassiman et al. 2005; Cloodt et al. 2006; Cefis & Marsili 2019). In terms of the orientation, Cassiman et al. (2005) argue that orientation, skills, language, and cognitive structures facilitate communication and learning.

by Caves (1989), Kay and Thompson (1986),Vernon-Wortzel and Wortzel (1989), Martin and Parker (1995), and Kole and Mulherin (1997) suggest that state ownership is not necessarily less efficient than private ownership. In terms of state ownership and M&A performance, Zhou *et al*. (2015) find that SOE acquirers outperform POE acquirers in regard to long-run stock performance and operating performance. They propose three main channels through which state-ownership has an impact on post-M&A performance. First, they show that state ownership may help acquirers secure governmental support to acquire target firms in industries under tight government control; second, state-owned acquirers (SOA) may have financial support for the deal; and, third, government intervention may also help SOA in the bid competition (Wang *et al.* 2011).

Following this line of research, the first hypothesis of Chapter 3 is that SOE acquirers would achieve better post-acquisition innovation performance, which would manifest as an increase in both R&D expenditure and the number of new patent registrations. There are two main channels through which state-owned (SOE) acquirers can outperform private-owned (POEs) acquirers in terms of innovation. First, SOE acquirers are provided better resources by the government than are POE acquirers. Second, SOE acquirers are likely to successfully integrate themselves with the target firm, facilitating the following knowledge-base integration and hence the innovation performance. Meanwhile, the business networking of SOE acquirers with preferential access to production inputs and the smoothing of regulatory processes (Sun *et al.* 2002) facilitates them to compete for the right target and to thus reduce the risk of post-acquisition integration.

The second hypothesis considers the impact of innovation orientation, which has been favourable to society in recent years, and proposes that responsible innovation orientation shapes the post-acquisition innovation pattern of SOEs. The orientation of responsible innovation is the right impact on society (Owen *et al.* 2012). Firms with responsible innovation orientation invest more in exploring new knowledge and solving non-routine problems, which is risky and time-consuming (Uotila *et al.* 2009). In terms of the SOE acquirers, although they

have more favourable resources and capacity than POE acquirers, the post-M&A innovation patterns (both input and output) of SOE acquirers are likely to be differentiated by the responsible-innovation orientation.

Using a patent-merger dataset over the period 2009–2015 for 1,128 Chinese domestic M&A deals, I find that state-owned acquirers (SOE acquirers) invest more in R&D and generate more patents following M&A than their private-owned counterparts. Furthermore, I find that the increase of R&D investment following M&A is likely to occur in SOEs that are oriented to responsible innovation, whereas the increase of patent counts subsequent to M&A is often observed in other SOE acquirers. These results suggest that state ownership in China does drive the acquirers' post-M&A innovation and that responsible innovation orientation plays an important role in differentiating the growth patterns of R&D spending and patent publications. I also find that the market tends to negatively react to the acquisition announced by responsible-innovation-oriented SOE acquirers (RIOSOE acquirers) in the short term. Meanwhile, in the long term, both market and operational performances indicate an upward trajectory for RIOSOE acquirers subsequent to M&A.

Chapter 3 contributes to the literature on the impact of state ownership and corporate performance by showing a positive relationship between state ownership and post-M&A innovation performance. In addition, this study supplements the literature explaining the heterogeneity of acquirer's post-M&A innovation performance (Cassiman *et al*. 2005; Bena & Li 2014) by introducing the responsible innovation orientation.

The final empirical essay in Chapter 4 focuses on the impact of firms' CSR efforts on firm value. Using a large sample of Chinese companies' domestic M&A, this study examines whether acquirers' CSR pays back in the context of M&A activity. This research aims to shed light on the debate around whether CSR creates value for shareholders. Some studies view CSR-related expenditure as a waste of valuable resources. They consider CSR activities to reflect managerial agency problems and believe that CSR-related expenditure results in benefits

enjoyed by non-financial stakeholders at the expense of shareholders (Servaes & Tamayo 2013; Masulis & Reza 2015; Buchanan *et al.* 2018). Others hold an 'instrumental stakeholder view' and demonstrate that CSR could be compensated as firms invest more in CSR (high ESG[2] rating firms) and earn the trust of stakeholders (i.e. employees, capital providers, and authorities) through forging a strong reputation for honouring implicit contracts (Arouri *et al.* 2019; Cornell & Shapiro 2021), thus encouraging stakeholders to 'purchase' this contract by committing resources and efforts to the firm's operation (Deng *et al.* 2013; Bettinazzi & Zollo 2017; Lins *et al.* 2017; Cornell & Shapiro 2021).

Chapter 4 empirically tests the 'instrumental stakeholder view' in the context of M&A and considers both ESG rating, and its dynamics. I use M&A as a testing ground for two reasons. First, as one of the most important corporate investment decisions, M&A can have a significant impact on firms' financial performance (Ahern & Weston 2007). Successful M&A can bring synergy to operations while unsuccessful M&A can cause losses. Moreover, stakeholders' action is crucial to M&A success (Anderson *et al.* 2012; Meglio 2016). Second, since M&As are typically unpredictable occurrences, including M&A performance in the study may help alleviate the reverse causality issue that has plagued past research on the relationship between CSR/ESG and firms' financial performance (Waddock & Graves 1997; Teoh *et al.* 1999; McWilliams & Siegel 2000; Jiao 2010).

Based on the instrumental stakeholder view, Hypothesis 1 in Chapter 4 states that high ESG acquirers will have better post-M&A performance. In terms of the dynamics of ESG efforts (ESG upgrade or downgrade) on post-M&A performance, Chapter 4 proposes the initial ESG standard dependent view, derived from the law of diminishing marginal utility (DMU) which indicates that stakeholders' satisfaction with and trust in firms decreases in line with a marginal

[2] ESG refers to Environmental(E), Social(S), and Governance (G) and incorporates three pillars through which a firm's sustainability, responsibility, and ethical practices toward stakeholders could be evaluated.

increase in welfare (Kauder 2015). ESG downgrade is expected to be negatively related to post-M&A performance for acquirers with high initial ESG performance level and that ESG upgrade is expected to be positively related to post-M&A performance for acquirers with low initial ESG performance level.

The results presented in Chapter 4 show that acquirers' ESG rating is positively related to post-M&A market performance and operational performance. Additionally, Chapter 4 demonstrates that the effect of acquirers' ESG upgrade and downgrade on post-acquisition performance is contingent upon the firm's previous ESG achievement. For acquirers with high initial ESG standards, an increase in ESG rating has little effect on post-M&A performance, whereas a decrease in ESG rating can result in significant poor performance. For acquirers with relatively low initial ESG standards, the positive impact of an increase in ESG rating prior to the acquisition on post-merger performance is more significant. Similarly, the results show that acquirers who have a high ESG rating or who undergo an ESG rating upgrade after starting with low ESG are more likely to conduct positive-return deals and thereby complete a deal. Overall, these findings support the instrumental stakeholder view and emphasise the asymmetric marginal outcome of firms' ESG efforts as the result of the diminishing marginal utility of stakeholders.

Chapter 4 makes several contributions. First, it contributes to the literature investigating whether and how firms' ESG investment is paid back in the context of M&A. Second, this research supplements studies on the functions of corporate social capital and post-M&A performance. Finally, it contributes to the strand of literature that considers the role of stakeholders' utility in the ESG value creation process (Harrison *et al.* 2010; Garriga 2014).

The remainder of this thesis is organized as follows. Chapter 2 empirically investigates the corporate cash holding in the zodiac year of chairpersons. Chapter 3 analyses the impact of state ownership and responsible innovation orientation on post-M&A innovation performance.

Chapter 4 examines the financial benefit of firms' ESG efforts. Finally, Chapter 5 presents the main findings, contributions, and research implications.

Chapter 2: Do Corporate Managers Believe in Luck? Evidence from the Chinese Zodiac and Corporate Cash Holding

2.1 Introduction

'Why are your companies performing so well?'

'Luck.'

—Lars Sørensen, rated the best-performing chief executive officer of 2015 by *Harvard Business Review*

Starting with the pioneering work of Roll (1986), numerous studies have analysed the effect of cognitive bias on managerial behaviour, including overconfidence (Malmendier & Tate 2005, 2008), hubris (Hayward & Hambrick 1997), optimism (Landier & Thesmar 2009), and heuristics (Dessaint & Matray 2017). A common thread underlying this line of research is the effect of cognitive bias on managers' assessment of risk and hence on their behaviour. Following this line of literature, this paper asks whether firm managers irrationally believe in luck and thus make predictable risk assessment errors that could affect corporate policies (e.g. cash holdings) and outcomes.

According to the psychology literature, individuals with a belief in bad or good luck consider luck to be a deterministic phenomenon, while rational individuals view luck as simply the outcome of random chance and unpredictable events (Darke & Freedman 1997; Rand 2009; Zhou *et al.* 2012; Thompson & Prendergast 2013). The psychology literature shows that this irrational belief in bad or good luck does, however, have an impact on an individual's risk expectation and, accordingly, affects the individual's behaviour. Following the illusion of control theory (Langer 1975; Wohl & Enzle 2002), belief in bad or good luck will make individuals either underestimate or overestimate their control over what might otherwise be considered fortuitous events. Hence, there may be a tendency to either overestimate or

underestimate the probability of a negative outcome from an uncertain event, even though its actual probability remains unchanged. Thus, if firm managers believe in bad (or good) luck, their perception of risk may be higher (or lower) than the actual risk. Specifically, Inhypothesise that the perceived risk of managers affected by such cognitive bias increases (or decreases) depending on the strength of belief in bad (or good) luck.

The empirical testing of this hypothesis faces two main obstacles. First, the risk perceived by the manager cannot be directly observed. To address this issue, I focus on how managers estimate the risk of liquidity at the company level, and I use recorded variations in corporate cash holdings to measure how their perception of risk changes. Given evidence that corporate cash holdings are primarily used as a buffer against the risk of a liquidity shortage,[3] any variation in cash holdings will provide a good indication of changes in managers' risk perception. Second, direct observation of managers' beliefs regarding luck is unfeasible since they may be reluctant to express such beliefs. I address this problem by testing managers' reactions to their Chinese zodiac year when it is believed to predict bad luck.

The culture surrounding the Chinese zodiac year (*Ben Ming Nian*) is well suited for my purposes since an individual's zodiac year is widely believed to be connected to their level of personal luck. According to traditional Chinese astrology, individuals entering their zodiac year are expected to encounter bad luck, which can manifest in the form of the loss of money, relationship difficulties, and career challenges. Second, zodiac years can be considered exogenous to both firms and individual managers because they occur cyclically every 12 years

[3] Froot and O'Connell (1999) and Holmström and Tirole (2000) provide a theoretical basis for predicting that cash will be used in imperfect financial markets as an insurance mechanism against the risk of liquidity shock. Several papers empirically document a positive correlation among various possible sources of cash shortfall in the future and current cash holdings; these studies thus confirm that precautionary motives are central to the accumulation of cash reserves (Kim *et al.* 1998 and Sherman, 1998; Opler *et al.* 1999 and Williamson, 1999; Almeida *et al.* 2004 2004; Bates *et al.* 2009 2009; Acharya *et al.* 2012 2012).

based upon the individual's birth year. From an empirical analysis perspective, the zodiac year provides a random setting, since, in any given year, a twelfth of the population will be in their zodiac year. Hence, variations in corporate policies observed around a manager's zodiac year cannot easily be attributed to unobserved heterogeneity or reverse causality. Finally, belief in bad luck attributed to one's zodiac year still retains broad influence in China; even individuals raised with modern belief systems are still taught to avoid major life changes during their zodiac year (Fisman *et al.* 2019). These cultural expectations of the zodiac year allow us to estimate the effect of the belief in luck on managers' perceived risk by comparing how firms adjust their cash holdings during their managers' zodiac year.

I analyse the reaction of chairpersons in terms of corporate cash holdings in relation to their zodiac year to investigate whether they irrationally believe in luck and thus make predictable risk assessment errors that may adversely affect company policies. Thus, within the context of the widely held Chinese zodiac year belief system, if chairpersons irrationally believe in luck, they may be expected to react to their zodiac year in their decision making. Since such a belief is inherently irrational, their reactions are anticipated to be suboptimal and inefficient.

To test my conjecture, I construct a data set pertaining to the chairpersons of Chinese listed firms. In particular, I establish the name, birth year, gender, and educational achievements of 3,756 board chairpersons born in China from a sample of all 2,557 listed non-state-owned enterprises (non-SOEs) during the period 2007–2018. I focus on the chairpersons of non-SOEs because they are, generally speaking, the ultimate decision makers of the firms and hence, by law, the highest decision-making authorities of these organisations[4] (Kato & Long 2006; Feng & Johansson 2018; Fisman *et al.* 2019).

In my baseline tests, I group firm years based on whether their chairpersons were in their zodiac year. I then compare the cash holdings levels of those firms managed by chairpersons in their

[4] See Section 4.1 for more detail on this.

zodiac year to others, before investigating the efficiency and optimality of the changes in cash holdings during managers' zodiac years by comparing the sources of the changes in cash holdings, as well as the value of such holdings.

I document two primary parameters pertaining to the cash responses of managers in their zodiac year. The first is how managers responded to their zodiac year in terms of increasing corporate cash holdings. The levels of cash holdings of chairpersons in their zodiac year increased by approximately 0.7 percentage points of total assets relative to other firm years. Second, this increase in cash holdings was temporary because the level of cash holdings increased from the end of the quarter prior to the commencement of the zodiac year until the end of that zodiac year, after which it immediately reverted to pre-zodiac year levels. Both findings are consistent with the prevalence of a belief system relating to good or bad luck. Notably, the belief in bad luck associated with one's zodiac year increases perceived risk and leads chairpersons to increase their cash holdings as a precautionary measure, even though the real underlying risk has not changed. As the zodiac year passes, both perceived risk and cash holdings revert to pre-zodiac year levels.

In the specific context of the study, the decisions of chairpersons in their zodiac year are deemed to be suboptimal and inefficient since the increase in corporate cash holdings reflects a distortion of resource allocation and a decrease in cash value. By applying the mediation effect model, I show that chairpersons increase their retention of earnings and/or decrease risky investments – for example, R&D or M&As – during their zodiac year. Such behaviour partially explains the increases in corporate cash holdings observed, indicating a distortion of resource allocation. Moreover, the increase in cash holdings directly affects shareholder wealth. Using the methodology of Faulkender and Wang (2006), I show that the market value (in terms of cash) decreases for those firms whose chairperson is in a zodiac year, since the additional cash leads to a smaller increase in market capitalisation relative to other firms, suggesting that markets see such actions as wasteful and inefficient.

I also perform a battery of additional analyses. First, I find that the zodiac effect is nonsignificant for SOEs. This result suggests that, unlike in non-SOEs, chairpersons in SOEs serve more of a custodial role in carrying out the government's wishes. Second, I find results remain essentially unchanged when I run robustness checks controlling for industry, time, and chairperson birth year fixed effects, as well as other chairperson characteristics (e.g. education, experience, and gender). In addition, I find that results remain robust to using an alternative proxy measurement for corporate cash holdings. Furthermore, I use propensity score matching (PSM) to ensure that the chairperson's zodiac year effect is not otherwise explained by observable differences in the characteristics of a given firm or chairperson in relation to those firms managed by chairpersons in their zodiac year.

Overall, my results support the contention that corporate chairpersons believe in luck. The ramifications of this cognitive bias are that it unduly affects their assessment of risk and leads to suboptimal corporate policies. Since the cash holding increase in zodiac year reflects the cognitive bias and leads to a deterioration of firm value of cash, the economic implication of zodiac year on firm development could not be ignored.

This paper makes several contributions. First, it contributes to a growing literature on the effects of managerial cognitive bias and corporate behaviour. Previous studies in this field have primarily focused on hubris, overconfidence, and optimism (Roll 1986; Malmendier & Tate 2005, 2008; Landier & Thesmar 2009) or heuristics (Dessaint & Matray 2017). In contrast, research into managers' belief in luck remains scarce. Although a related study by Fisman *et al.* (2019) analyses the effect of zodiac years, it primarily focuses on two types of risky corporate investment**,** meaning that there is no overarching discussion of the mechanisms or outcomes of the zodiac year effect. Thus, my paper adds to the literature by producing novel evidence regarding corporate liquidity reactions to a negative zodiac year shock to an individual's perceived luck. Moreover, I use quarterly data to provide more precise evidence on the effect during the whole zodiac year. Finally, my finding that zodiac year beliefs lead

chairpersons to make suboptimal decisions that destroy the value of cash for shareholders improves our understanding of the efficiency of the link between belief in luck and risk taking. My study also makes important contributions to the literature on corporate cash holdings by showing that the chairperson's belief in luck, a form of cognitive bias, significantly affects the average value of cash holdings. The prior literature emphasises the role of a firm's financial constraint (Faulkender & Wang 2006), growth opportunities (Denis & Sibilkov 2010), corporate governance (Pinkowitz & Williamson 2002), and chief executive officer risk taking incentives (Liu *et al.* 2014). This study adds the dimension of cash holdings to the chairperson's belief in luck, which negatively affects the value of cash.

The remainder of the paper is structured as follows. Section 2 reviews the literature on zodiac year belief and belief in luck. Section 3 presents the testable hypotheses. Section 4 details the data and methodology. Section 5 outlines the results. Finally, Section 6 concludes the paper.

2.2 Literature review

2.2.1 Zodiac year

According to traditional Chinese astrology, each lunar year in a 12-year cycle is assigned a specific animal as part of the Chinese zodiac (*sheng xiao*) classification scheme. The Chinese zodiac begins with the sign of the Rat, followed by the Ox, Tiger, Rabbit, Dragon, Snake, Horse, Goat, Monkey, Rooster, Dog, and finally the Pig (Robiyanto *et al.* 2015). Every person has a zodiac sign designated based on his or her Chinese lunar year of birth. For example, a person's zodiac sign is the Tiger if they were born in the year of the Tiger. Every 12 years, starting with the birth year, a person's individual zodiac sign will align with the zodiac sign of that year. This lunar year is called the person's zodiac year, or *Ben Ming Nian*.

Based on the relation between one's birth year and the zodiac, the Chinese intuitively relate the zodiac to one's luck. For example, the zodiac year (*Ben Ming Nian*) is commonly associated with bad luck. The Chinese believe that individuals in their zodiac year may come into conflict with Tai Sui, a mysterious power or celestial body that controls people's fortunes. This conflict

puts them at greater risk of such misfortunes as health issues, relationship difficulties, career challenges, and economic loss. Accordingly, individuals in their zodiac year are advised to exercise extreme caution in their decision making and in any situations they might encounter (Zhou 1994).

The culture surrounding the Chinese zodiac year (*Ben Ming Nian*) provides a rare opportunity to systematically study the effect of belief in luck on chairpersons' decision making with little concern about endogeneity. As previously mentioned, one's zodiac year is believed to relate to luck and recurs every twelfth year from one's birth. In any given year, then, a random one-twelfth of any given population will be in their zodiac year, providing a random setting for empirical analysis. Therefore, it is reasonable to assume that the zodiac year effect constitutes a clear exogenous shock. Second, belief in bad luck during one's zodiac year is still widespread across China, and even individuals with modern outlooks avoid major life changes during their zodiac year (Fisman *et al.* 2019). This allows us to objectively study the irrational effects of belief in luck by analysing the reactions of corporate board chairpersons during their zodiac year. Their reactions to predictions of bad luck in their zodiac year are associated with their irrational belief in luck (i.e. where personal luck affects their future expectations).

2.2.2 Belief in luck

I can easily observe in daily life the following phenomenon: some people cannot stop gambling because they believe that their good luck will help them to win the game, and this good luck makes them believe that their chance of winning will be high (e.g. 70%), despite the fact that the probability of winning is actually very low (e.g. 5%) and they have lost many times before. This phenomenon implies that individuals' behaviour is likely to be affected by a kind of belief regarding luck.

Belief in luck is an irrational cognition about luck (Day & Maltby 2003). Individuals who hold an irrational belief in luck consider the existence of luck to be a deterministic phenomenon, whereas rational individuals view luck simply as a random and unpredictable occurrence

(Darke & Freedman 1997; Thompson & Prendergast 2013). In addition, individuals' belief in luck is associated with their expectations for external control (external locus of control hypothesis) (Rotter 1966; Kelley 1967; Weiner 1972; Darke & Freedman 1997). By believing in luck, individuals tend to irrationally consider the result of an event to be the product of external factors such as chance and luck (Rotter 1966).

Belief in luck often manifests as irrationality when making decisions about probability events (Chiu & Storm 2010). The irrational cognition regarding luck can increase one's unrealistic optimism or pessimism and hence affect expectations in the decision-making process (Rotter 1966; Kelley 1967; Weiner 1972). Based on the external locus of control theory, individuals with a belief in luck are more likely to be affected by external factors that are unrelated to actual risk. External factors, such as belief about personal luck and/or its proximity, can generate a discrepancy between perceived and actual risk. According to Damisch *et al.* (2010), in particular, belief in good luck may make individuals overrate the probability of a positive outcome (i.e. winning the game) although its actual probability is low, while belief in bad luck, by contrast, will make individuals underrate the probability of a negative outcome (i.e. suffering loss) despite its actual probability being high. In other words, individuals who believe in good luck underestimate risk while those who believe in bad luck overestimate risk.

2.2.3 Corporate cash holdings

The corporate cash reserve is the most liquid asset of a firm and is also an important measure of the firm's solvency. Cash is important to a firm as it provides them with the liquidity to pay for their debt, especially in imperfect financial circumstances, and it also enables them to finance investment projects and their routine corporate operations. In order to boost revenue and profit, a firm must build up cash holdings by maintaining an overall positive cash flow position. Therefore, cash can be seen as an essential element that enables a business's survival and prosperity.

In this section, I will first introduce the theoretical models that can help to explain corporate cash holding decisions. I then discuss the literature on the value of cash. Finally, I review the literature on the relationship between cash holding and corporate risk management.

Theories about cash holding behaviour

Several theories constitute the foundation of empirical research concerning corporate cash holdings behaviour. Some are derived from capital structure research, while others are specifically generated to explain corporate cash policy. A common reference point for all these grounding thoughts is the irrelevance of the capital structure according to Modigliani and Miller (1958), who argue in their research on corporate capital structure that in perfect capital markets a firm's value is independent of its source of financing. Capital structure theories demonstrate the results of relaxing the perfect capital market presumption. They analyse circumstances when capital structure influences firm value.

Several theoretical perspectives have been formulated in determining the cash holding pattern of firms. Based on previous literature, the grounding theories that have remained more pertinent to cash management practices of firms include trade-off, pecking order, and free cash flow theories (Wasiuzzaman 2014).

Trade-off theory The trade-off theory is derived based on the initial paper when taxes were taken into account by Modigliani and Miller (1963). Its primary properties are the trade-off between the tax-deductibility of debt and bankruptcy costs as well as the presence of an ideal capital structure. When converting the trade-off theory from justifying the capital structure to explaining the corporate cash pattern, the costs and benefits of holding cash are considered. Cash holdings are presumed to stem from operating cash flow and not from issuing debt. The benefits of holding cash spring from Keynes (1936) theory regarding the motive of transaction cost motive and precautionary motive. In terms of transaction cost motive, holding cash allows firms to avoid or save transaction costs that are incurred in case of external financing. In line with the transaction motives, firms hold the cash only to overcome the higher opportunity cost

in case of lower cash levels (Tobin 1956; Miller & Orr 1966; Dittmar *et al.* 2003). According to the precautionary motive, cash holding enables firms to finance their investments or project if other financing sources are not available. In addition, Ozkan and Ozkan (2004) noted that in the case of a higher cost of external financing, firms also invest in liquid assets or enhance their cash level. This argument is similarly supported by Opler *et al.* (1999). The costs of cash accumulating also contain several factors. The firm is incapable of investing cash and thus misses returns as well as tax-induced benefits from debt financing (Kim *et al.* 1998). Besides, cash can possibly be utilised at managers' discretion and thus incurs agency costs (Jensen 1986). The result of this trade-off is that the value of cash depends on its costs and benefits. Hence, an ideal level of cash can be inferred from these contemplations. In general, there are two types of trade-off model: a static and a dynamic version.

The static trade-off model involves only one period. This model does not offer a testable hypothesis because the assumed optimal cash target is achieved immediately as a result of the one-period trade-off. Therefore, an observation of target alteration does not provide a premise for verification or dismiss the static trade-off hypothesis as Frank and Goyal (2008) point out.

The dynamic trade-off model extends the temporal scope of the static model by considering a multi-period set-up uncertainty brought about by the improvement of corporate funds, financing needs, investment possibilities, and transaction costs. In terms of the testable hypothesis, the dynamic model suggests an ideal cash level, which a firm alters towards. Therefore, an observation of altering towards a target level of cash serves as proof for the dynamic trade-off hypothesis.

Pecking-order theory The pecking-order hypothesis focuses on agency costs and more specifically on hidden characteristics consistent with Akerlof (1978). Based on this premise, it determines a model that predicts a firm's cash, debt, and capital utilisation without determining a target capital structure. The pecking-order theory is further developed by Myers (1984), according to whom firms follow an order when choosing which funds to use in the financing

of investments. Firstly, firms prefer internal funds to finance investment projects. Secondly, they will alter their dividend levels, though dividend policy tends to be sticky. Firms will then opt to sell liquid assets and eventually use their external capital as a last resort. If outside financing is required, firms prefer debt to hybrid securities, including convertibles, and eventually the issuance of equity (Myers 1984).

This order of financing comes from the theory of asymmetric information between a company and its potential investors regarding the company's value. The firm must raise funds to finance a project and is aware of its true value. However, if it is currently undervalued, the firm also has the incentive to miss positive NPV projects. This is the case when the NPV added to the firm from the project is lower than the undervaluation, i.e. when the cost of issuing undervalued equity is not offset by the project's profit. On the other hand, if the company is overvalued, the firm prefers to issue equity because the firm knows that the earning from the new project will be higher than the true value of the firm's equity. Therefore, issuing equity is a negative signal for investors who will either avoid securities or demand an interest premium. A positive NPV project will, therefore, first be financed by internal funds, i.e. hoarded cash to avoid the problem of underinvestment as well as the agency costs associated with debt and equity. If further external funds are required, the firm prefers debt to equity because of the negative signalling effect attached to equity and the positive signalling effect of debt. This positive signal of debt results from the firm's willingness to oblige themselves to fixed interest payments.

The level of cash holding is an outcome of a firm's investment and financing decisions. Firms use their cash flow to fund their investment opportunities, to repay the debt when due, and to then collect the unused cash flow as cash holding if possible. If cash flow cannot cover the above expenditure, firms may use cash reserves as a buffer against external financing. If operating cash flow and cash reserve together are still not sufficient to cover the investments, additional external financing is needed. As a result, the level of cash holding is determined by cash inflow and outflow, implying that there is no optimal cash holding level (Opler *et al.* 1999).

Free cash flow theory Another prominent model explaining cash holding policies is the free cash flow theory (FCF) established by Jensen and Meckling (1976). Though in some cases the term agency theory is used as a synonym for FCF theory (Faleye 2004; Bates *et al.* 2009), it does not include all agency conflicts but rather just the threat of having a non-owner manager who tends to hoard cash in order to maximise his or her own utility instead of the owner's. According to Jensen (1986), managers prefer to maintain a high level of cash holding to enhance the volume of total assets under their control as they try to gain power over the firm's investment and financing decisions. Under this FCF-hypothesis, cash holding may lead to over-investment issues (Ferreira & Vilela 2004). To be more specific, having cash available to invest means that the manager does not need to raise external funds nor provide capital markets with detailed information about the firm's investment projects. Hence, managers could undertake investments that have a negative impact on shareholders' wealth.

Finally, it can be argued that management may accumulate cash because it does not want to make payouts to the shareholders and wants instead to hold these funds under the control of managers. Drobetz and Grüninger (2007) support this argument, revealing that dividend payments are positively related to cash reserves. This indicates that, in order to keep funds within the firm, management may accumulate cash by reducing the dividend or by not making payouts to shareholders.

Value of cash

Beginning with the work of Faulkender and Wang (2006) and Pinkowitz *et al.* (2006), various studies have analysed the value of corporate cash holdings, i.e. the value that the market assigns to an extra dollar of cash holding. There are two types of theories regarding the value of cash holdings. The traditional views are that the value of cash depends on (1) the information asymmetry between managers and investors in the market (Myers 1984) and (2) the agency problems that emerge due to the misalignment of managerial and shareholder interest (Jensen & Meckling 1976). A common assumption underlying these studies is that CEOs are rational. However, as a number of research studies in the corporate finance literature find that CEO

characteristics and behavioural biases affect corporate policies and decisions (Bertrand & Schoar 2003; Malmendier & Tate 2005; Hirshleifer *et al.* 2012; Huang & Kisgen 2013), the value of cash is expected to be affected by the CEO's irrational decisions. Aktas *et al.* (2019), meanwhile, show that cash holding is more valuable when firms are managed by overconfident CEOs. In addition, they point out that CEO overconfidence negatively affects the value of cash in financially unconstrained firms.

In a study by Dessaint and Matray (2017), the value of cash is used to analyse the cash holding's efficiency. They assume that if the cash holding is efficient, the increase in cash holding should translate into a similar increase in the value of cash holding, while if cash would have been better employed otherwise, the additional cash hold will be discounted and will not result in a similar increase in terms of corporate value. Under this assumption, they show that the salience of risk would make corporate cash holding suboptimal.

Cash and corporate risk

Numerous empirical papers have confirmed that cash holdings increase with liquidity risk (Stulz 1984; Kim *et al.* 1998; Ramirez & Altay 2011). Moreover, it has been found that surveys of CFOs confirm this link as a sizeable majority of CFOs declare the use of cash for general insurance purposes (Lins *et al.* 2010). Froot *et al.* (1993), who do not explicitly focus on cash holdings but rather on the use of hedging instruments, show that when financial markets are not perfect, firms may not be able to take advantage of investment opportunities because it is costly or impossible to raise external finance. This means that it is valuable to hedge to reduce the variability of internal funds that are available. In a similar vein, Holmström and Tirole (2000) show that when the full value of some investment projects cannot be pledged because part of the cake needs to be used to incentivise the managers, then it is valuable to hoard cash ex-ante to insure against the risk that valuable projects are not refinanced.

Cash holdings may also be used as a defence against hostile takeover risk. Consequently, cash holdings are expected to rise when the danger of hostile interference is present. A high corporate cash balance is believed to ease the application of anti-takeover actions, such as stock repurchases. These theoretical predictions are supported by empirical results from Harford (1999), who shows that the probability of being acquired in the context of a hostile takeover can effectively be lowered by increasing corporate cash reserves. The motive of hostile takeover defence seems to conflict with the free cash flow hypothesis, which states that excessive cash is the result of managerial discretion and leads to value-decreasing investments. Such value-destroying actions are expected to be disciplined by the market; indeed, companies that are subject to managerial misuse of cash are more likely to be the target of takeovers.

2.3 Hypotheses

2.3.1 Cash holdings in the zodiac year

I ask whether corporate managers believe in good or bad luck and hence overreact to risk arising in their zodiac year. If managers believe in luck, their level of perceived risk is generally too low when they expect good luck and too high when they expect bad luck. This implies that temporary changes in perceived risk will be observed in response to a 'lucky' event or outcome, even though the real underlying risk does not change. Specifically, managers' perceived risk will increase in zodiac years, which are traditionally believed to bring bad luck. To test this prediction, I assume that changes in risk perception can be inferred from variations in corporate cash holdings. Prior research shows that risk management is the main driver of cash holding policies. When firms have limited access to external financing, cash is used as an insurance mechanism against the risk of liquidity deficit (Froot & O'Connell 1999 1993; Holmström & Tirole 2000). In other words, cash holdings offer a buffer against any risks in terms of cash shortages, allowing firms to finance valuable investment opportunities.

In terms of the Chinese zodiac year (event of interest), managers who believe in luck will tend to set aside cash for the whole year because the zodiac year belief predicts that the bad luck lasts from the first day of the Chinese Lunar New Year until the last. Thus, it is very reasonable

to predict that managers will increase cash holdings before the beginning of a zodiac year as a precautionary move, and I therefore propose the following hypothesis:

H1: Corporate cash holdings will increase during a chairperson's zodiac year.

2.3.2 Sources of cash

Because the liquidity risk is unlikely to change during a chairperson's zodiac year, increasing cash holdings may be deemed suboptimal resource allocation. Therefore, my second hypothesis relates to changes in the counterparts to this increase in cash holdings. Possible sources of increases in cash holdings are an increase in operating profits, a drop in operating investments, a decrease in risky investments, an increase in new financing from debt or equity, or an increase in earnings retention. If a change in cash holdings is the result of the 'shock factor' of luck brought about by a zodiac year, then an increase in operating cash flow and a drop in net working capital are less likely. This is because it is a chairperson's belief in bad luck that likely has a psychological impact on them, rather than the actual changes in operating profit or working capital requirements. In addition, to avoid risk, those managers who believe in luck are less likely to raise new funding in their zodiac year. However, since the perceived risk is greater in their zodiac year, managers are more likely to retain cash from earnings and to decrease risky investments, which leads to the following hypotheses:

H2a: Chairpersons will retain more earnings in their zodiac year.
H2b: Chairpersons will decrease risky investments in their zodiac year.

2.3.3 Value of cash

I now address whether changes in cash holdings in a chairperson's zodiac year are due to a rational decision-making process or a source of value destruction for corporate shareholders. If such a decision is rational, any increase in cash holdings should be efficiently used and hence lead to a similar increase in cash value for the firm's shareholders. If such cash holdings could

have been better employed elsewhere, the additional cash holdings could incur a potential loss to shareholders in terms of market capitalisation.

According to my first prediction, chairpersons who believe in luck will overestimate the risk arising in their zodiac year and hence irrationally increase cash holdings. Such a reaction is likely to be costly for shareholders, since increasing cash holdings in this case is suboptimal in terms of resource allocation. Therefore, I hypothesise the following:

H3: The value of cash holdings will decrease during the chairperson's zodiac year.

2.4 Data and methodology

2.4.1 Data

I construct my main sample by combining two data sets. The first data set comprises all non-SOEs[5] listed on the Shanghai and Shenzhen Stock Exchanges from 2007 to 2018. Information on these firms was collected from the China Securities Market & Accounting Research (CSMAR) database. I study non-SOEs rather than SOEs because the decisions of the former, being under less formal political control, are less likely to be affected by politics (Zif 1981; Liang & Ma 2020), and SOEs thus enjoy greater autonomy in relation to their business goals. I select 2007 as the starting year because a new corporate accounting standard was implemented at this time that made the disclosure of financial indicators (such as R&D expenditure) more comprehensive and hence transparent. To eliminate the impact of abnormal financial conditions, I exclude firms tagged ST and *ST[6] from my samples.

[5] I identify non-SOEs according to the nature of the ultimate controller. Specifically, I require that non-SOEs not be controlled by the central government, a local government, a proxy administrative agency, or any other SOE.

[6] According to regulations in China, if a firm reports two consecutive years of negative profits, the prefix ST is added to its name abbreviation to warn investors of substantial risk. If an ST firm experiences a third year of negative net profits, an asterisk is added to alert potential investors to the fact that the company is very close to being delisted.

Second, I construct a data set where I identify the board chairs for non-SOEs listed on the Shanghai and Shenzhen Stock Exchanges. I first collect the names of the board chairs from the CSMAR database. I then retrieve their biographical data, including their age, gender, highest educational achievement, and nationality via searches of Genius Finance, Sina Finance, or Google/Baidu. I exclude foreign-born board chairs (1.9% of chairpersons in my main sample) to minimise cultural differences. I focus on chairpersons instead of chief executive officers because, in non-SOEs, the chairperson is generally the ultimate controller of the firm and is thus, by law, the highest decision-making authority within the organisation (Kato & Long 2006; Feng & Johansson 2018; Fisman *et al.* 2019).

By combining these two data sets, I construct a final main sample of 2,557 non-SOEs with 3,756 chairpersons. For these firms, I obtain quarterly financial data from the CSMAR database. In order to achieve the highest possible precision, I use quarterly rather than annual data to identify changes in the cash holdings of these firms during their chairperson's zodiac year.

Table 2.1 presents descriptive statistics for the key dependent variables. Panel A reports summary statistics[7] for the whole sample, while Panel B presents similar statistics for the subsamples segmented by the chairperson's zodiac year. The last column in Panel B shows the *t*-statistics from a two-sample test of the equality of means across both zodiac and non-zodiac year firms. The difference in cash holdings is 1.034 percentage points (significant at the 1% level), the difference in corporate size is 0.042 (significant at the 5% level), while the difference in the market-to-book (*MTB*) ratio is -0.121 (significant at the 1% level). The latter suggests that firms are relatively undervalued during the chairperson's zodiac year compared to other years. The difference in net working capital (*NWC*) is 0.6% (significant at the 5% level) and, accordingly, the difference in capital expenditure is 0.1% (significant at the 1% level). In columns (1) and (2) of Panel C, I further present the means of cash for zodiac and non-zodiac

[7] All variables are winsorised at the first and 99th percentiles and are defined in Appendix A.

firms, respectively, as well as their differences by quarter. The difference in cash holdings is significant for each quarter and gradually shrinks from quarter 1 (Q1) to quarter 4 (Q4). This result is also plotted in Figure 2.1.

Table 2.1 Descriptive statistics

This table reports firm-level summary statistics. The sample contains 2,557 non-SOEs, with data from CSMAR, over the period of 2007–2018. Panel A reports the statistics of the main variables in the full sample. Panel B presents the average values of the variables for the zodiac year and non–zodiac year groups, separately. Panel C presents the mean value of cash for the zodiac year and non–zodiac year firms by quarter. The last column shows the differences between the two samples. All continuous variables are winsorised at the first and 99th percentiles. The variables are defined in the Appendix. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Full sample (non-SOEs)						**Panel B**: Balance			
	N	Mean	SD	P25	P50	P75	Zodiac = 1	Zodiac = 0	Difference	t-Statistic
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(1) - (2)	(3)
Zodiac	63,778	8.57%	28%	0	0	0				
Age	63,778	51.93	7.994	47	51	57	51.788	51.942	-0.154	-1.368
Female	63,778	5.4%	22.6%	0	0	0	5%	5.4%	-0.4%	-1.524
Degree	59,940	3.278	0.98	3	3	4	3.291	3.277	0.014	0.953
Cash	63,763	18.49%	15.83%	7.246%	13.31%	24.55%	19.431%	18.397%	1.034%	4.616***
Size	63,778	21.64	1.151	20.81	21.49	22.26	21.673	21.631	0.042	2.571**
Leverage	63,778	38%	21%	20.7%	36.2%	53%	37.7%	38%	-0.3%	-1.319
MTB	60,825	2.68	2.58	1.14	1.92	3.23	2.568	2.689	-0.121	-3.257***

NWC	63,334	11.5%	20%	-0.965%	11.6%	24.4%	12.1%	11.5%	0.6%	2.280**
Cexp	63,692	3.4%	3.97%	0.651%	1.98%	4.64%	3.5%	3.4%	0.1%	2.614***
CF	63,778	2.99%	3.7%	0.765%	2.23%	4.69%	3%	3%	0%	1.211

Panel C:	Quarterly balance: Cash holdings (%)		
	Zodiac = 1	Zodiac = 0	Difference
	(1)	(2)	(1) - (2)
Q1	20.021%	18.454%	1.566%***
Q2	19.617%	18.459%	1.158%***
Q3	19.424%	18.466%	0.958%**
Q4	19.380%	18.467%	0.913%**

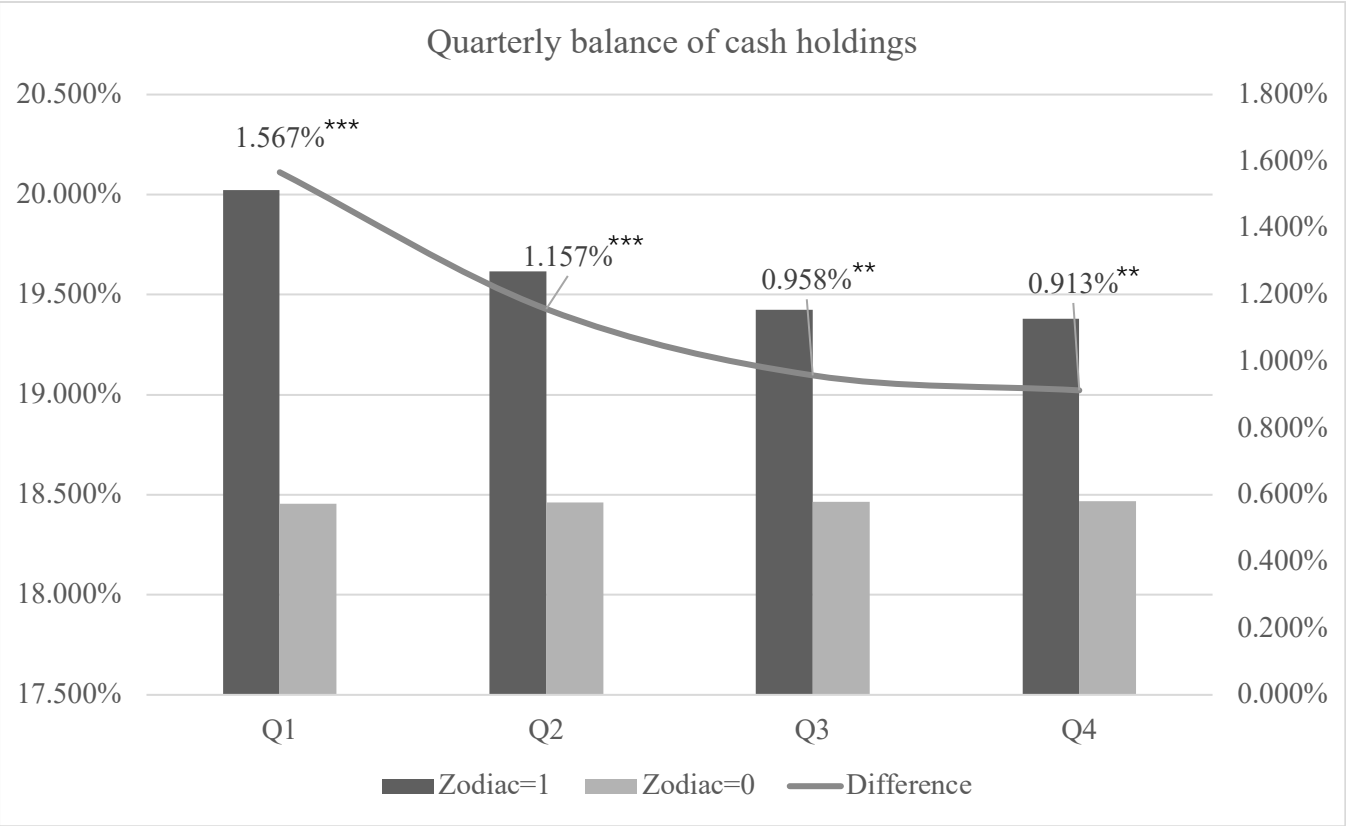

Figure 2.1 The quarterly balance of cash holdings (%)

The sample comprises data from CSMAR on 2,557 non-SOEs from 2007 to 2018. This graph compares the quarterly corporate cash holdings of firms with a chairperson in a zodiac year versus a chairperson in a non-zodiac year. The dark vertical bars plot the mean cash holdings for firms in each quarter of the zodiac

year, while the grey bars plot the mean cash holdings for firms in normal years. The solid line plots the differences between the two groups for each quarter. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

2.4.2 Methodology

Cash holdings in the chairperson's zodiac year

I examine the effects of belief in bad luck during the chairperson's zodiac year on risk perception, as determined via changes in corporate cash holdings, using the following model:

$$Cash_{iyqc} = \alpha_i + \delta_{yq} + \beta_1 Zodiac_{iyqc} + \chi_{iyq} + \gamma_{yqc} + \mu_{iyqc} \qquad (1)$$

where, for firm *i*, at the end of year *y*, calendar quarter q (1 to 4), and chairperson *c*, $Cash_{iyqc}$ is the amount of cash and cash equivalents as a percentage of total assets, α_i is firm fixed effects, δ_{yq} denotes time (i.e. year–quarter) fixed effects, $Zodiac_{iyqc}$ is a dummy variable that equals one if the firm's chairperson is in his or her zodiac year (hereafter extending from quarter 1 to quarter 4 of that year) and zero otherwise, and μ_{iyqc} is the error term, clustered at the firm level to account for potential serial correlations.[8]

I also add control variables for firm characteristics and the chairperson's personal characteristics. The firm control variables are denoted by χ_{iyq}, measured at the end of each quarter q of year *y*. These control variables are firm size (the natural logarithm of total assets), leverage (measured as the ratio of total debt to total assets), the market-to-book ratio (market capitalisation over total equity), capital expenditure (Cexp, capital expenditure scaled by total assets), NWC (the ratio of net working capital to total assets), and cash flow (the ratio of net earnings to total assets).

The control variables for the chairperson's personal characteristics, denoted by γ_{yqc}, are the age of the board chair (to control for the age effect on corporate cash holdings), being female (a dummy variable indicating whether the chairperson is female), and education (an indicator

[8] In Appendix B, I also apply robust standard errors and standard errors clustered at the industry level in this baseline model in order to relax the assumption that multiple observations from the same industry are uncorrelated. The results show that our findings are robust under more conservative considerations.

of the board chair's level of educational attainment, where 1 denotes a senior middle school degree or lower, 2 denotes a junior college degree, 3 denotes a bachelor's degree, 4 a master's degree, and 5 a doctoral degree. To alleviate concerns about an age effect in the relation between the zodiac year and corporate cash holdings, I additionally control for 12-year age cohorts centred around the zodiac year (i.e. [19, 30], [31, 42], etc.) in my models. Detailed definitions of all the variables used in the empirical analysis may be found in Appendix A.

Sources of cash

I first run an ordinary least squares (OLS) regression on the possible resources called upon for the increase in cash holdings, including operating margins, net working capital (*NWC*), and new financing, to check the rationale for the second hypothesis that these factors are less likely to be the key sources for increases in cash holdings during a zodiac year. The control variables are the chairperson's age, gender, and education, as well as the firm's size, leverage ratio, and market-to-book ratio. Firm and time fixed effects are also included in the analysis. Detailed definitions of all the variables in the empirical analysis may be found in Appendix A.

I then use the mediation effect model to test my second hypothesis relating to the sources of cash holdings. Using the mediating effect model of Baron and Kenny (1986), I supplement the baseline model with the following regression:

$$Source_{iyqc} = \alpha_i + \delta_{yq} + \beta_2 Zodiac_{iyqc} + \varphi_{iyq} + \gamma_{yqc} + \mu_{iyqc} \quad (2)$$

$$Cash_{iyqc} = \alpha_i + \delta_{yq} + \beta_3 Zodiac_{iyqc} + \beta_4 Souce_{iyqc} + \chi_{iyq} + \gamma_{yqc} + \mu_{iyqc} \quad (3)$$

where $Source_{iyqc}$ includes earnings retention and risky investments. In keeping with previous studies, I use the reduction in dividend payouts (Dessaint & Matray 2017) to measure earnings retention and use R&D and M&A expenditures as proxies for risky investments. I considered M&A investments to be risky because corporate acquisitions are deemed inherently riskier than organic internal growth due to the typically large commitment of time and resources (Bernile *et al.* 2017). I considered R&D expenditures to be risky because they involve multiple uncertainties (e.g. the time and scale of the investment). Second, many studies have previously adopted M&A and R&D expenditures as proxies for risky investments (Coles *et al.* 2006;

Cassell *et al.* 2012; Kini & Williams 2012; Feng & Johansson 2018; Fisman *et al.* 2019). The control variables in Eq. (2) are γ_{yqc} (essentially the same as in Eq. (1)) and φ_{iyq} (which includes the firm's size, leverage ratio, and market-to-book ratio). The control variables employed in Eq. (3) are the same as in my baseline model, Eq. (1). The term μ_{iyqc} is the error term, clustered at the firm level to account for potential serial correlations.[9]

To analyse the mediation effect, the following three conditions must be met. First, the independent variable (*Zodiac*) should be significantly related to the dependent variable (*Cash*). Second, the independent variable (*Zodiac*) should be significantly related to the mediator variable (i.e. Source). Finally, the dependent variable (*Cash*) should be regressed against both the independent variable (*Zodiac*) and the mediator. Let us suppose that the mediator variable mediates the association between *Cash* and *Zodiac*. In this case, the mediator should be significant, and the significance of the independent variable of interest (i.e. *Zodiac*) should be reduced after the mediator variable is added to the regression.

Value of cash

To measure the impact of chairpersons' reactions to their zodiac year in terms of the value of cash holdings, I adopt the valuation model proposed by Faulkender and Wang (2006).[10] I augment their baseline model with zodiac year variable and add its interaction with the change in cash holdings variable. Specifically, I construct the following equation:

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[9] In Appendix B, I apply robust standard errors and standard errors clustered at the industry level in the mediation effect model to relax the assumption that multiple observations from the same industry are uncorrelated. The results show that our findings are robust under more conservative considerations.

[10] In a similar vein to Dessaint and Matray (2017), I apply one notable adjustment to the specification of Faulkender and Wang (2006) in that we do not use the market-adjusted return as a dependent variable. Instead, I use the raw stock return and add time fixed effects, as suggested by Gormley and Matsa (2014).

$$\Delta MV_{iyqc} = \alpha_i + \delta_{yq} + \beta_1 \frac{\Delta Cash_{iyqc}}{MV_{iyqc-1}} + \beta_2 (Zodiac_{iyqc}) + \beta_3 \left(Zodiac_{iyqc} * \frac{\Delta Cash_{iyqc}}{MV_{iyqc-1}} \right) + \partial_{iyq} + \gamma_{yqc} + \mu_{iyqc} \quad (4)$$

where the dependent variable ΔMV_{iyqc} denotes the change in equity market value over quarter q, scaled by the equity market value at the end of the quarter q - 1, and $\Delta Cash_{iyqc}$ is the change in corporate cash holdings over the quarter, scaled by equity market value. The control variables for firm characteristics, denoted by ∂_{iyq}, include changes in earnings, interest, dividends, net assets, R&D expenditures, market leverage, new financing, lagged cash, and interaction terms between change in leverage and lagged cash, as well as between changes in cash and lagged cash. The controls for chairperson characteristics, denoted by γ_{yqc}, are similar to those in specification (1). I also control for firm fixed effects (α_i) and time fixed effects (δ_{yq}). I additionally control for 12-year age cohorts centred around the zodiac year (i.e. [19, 30], [31, 42], etc.). Finally, the term μ_{iyqc} is the error term clustered at the firm level to account for potential serial correlations.

2.5 Results

2.5.1 Cash holdings

I examine the effect of a belief in luck on the risk perceived by firm chairpersons through differences in corporate cash holdings during a chairperson's zodiac year. Table 2.2 reports the effects of chairpersons' belief in luck in their respective zodiac years. In the first column, I include only the variable zodiac as a covariate. I then add progressively more controls, including chairperson characteristics (columns (2) and (3)), firm characteristics controls (column (3)), and age cohort fixed effects (column (4)). According to the results in column (3), on average, during the chairperson's zodiac year, firms increased their cash holdings as a percentage of total assets by approximately 0.655 percentage points during the four quarters of that year. This effect represents an average increase in cash holdings of approximately 16 million yuan. The coefficient of the zodiac variable is relatively stable across these specifications. Consistent with my first hypothesis, chairpersons respond to the prediction of

bad luck during their zodiac year by increasing their firm's cash holdings, although there is no indication that the risks were any greater than they were previously.

Table 2.2 Zodiac proximity and corporate cash holdings

This table presents OLS estimates of the effects of belief in bad luck on the level of corporate cash holdings during a chairperson's zodiac year. The dependent variable is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter, and Zodiac is a dummy variable equal to one if the chairperson of the firm is in a zodiac year. All other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Cash (%)				
	(1)	(2)	(3)	(4)
Zodiac	0.863***	0.737**	0.655***	0.717***
	(2.615)	(2.252)	(2.622)	(2.862)
Age		-0.610***	-0.280***	
		(-12.850)	(-8.072)	
Female		-2.971*	-1.817	-1.335
		(-1.792)	(-1.517)	(-1.141)
Education		-3.076***	-0.865***	-0.557*
		(-8.116)	(-2.630)	(-1.733)
Size			-3.662***	-3.925***
			(-10.562)	(-11.549)
Leverage			-58.136***	-58.110***
			(-28.048)	(-28.063)
MTB			-0.893***	-0.921***

			(-12.992)	(-13.353)
NWC			-51.293***	-51.498***
			(-30.842)	(-30.841)
Cexp			-14.860***	-14.400***
			(-5.527)	(-5.345)
CF			50.166***	51.288***
			(13.950)	(14.126)
Age cohort fixed effects				Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	63,763	59,925	56,708	56,708
Adj. R^2	0.407	0.439	0.658	0.656

I investigate the dynamics of this increase in cash holdings in Table 2.3, specifically studying the differences between the levels of cash holdings of those firms with a chairperson in his or her zodiac year and the others. I replace the zodiac variable with a set of dummy variables denoted by *Pre(Post)-zodiac qi and Zodiac qi*, indicating the quarters before (after) and during the chair's zodiac year. The regression coefficient estimated for each dummy variable measures the differences in the levels of quarterly cash holdings between firms in (before or after) the chairperson's zodiac year and others. This approach allows us to identify when the effect starts and how long it lasts.

Table 2.3 shows that the level of cash holdings begins to increase one quarter prior to the commencement of the zodiac year,[11] and these increases in cash holdings peak during the

[11] The positive and statistically significant effect observed for Pre-zodiac q4 is consistent with our interpretation of the precautionary cash holdings hypothesis. Since the Chinese lunar year begins between January and February in the Gregorian calendar, Zodiac q1 is the first balance

second quarter of the zodiac year. The coefficients for the *Zodiac q2* variables (the second quarter of the zodiac year) reveal that, on average, chairpersons in their zodiac year respond to premonitions of bad luck by increasing their firm's cash holdings by 0.766% of their total assets (approximately 19 million yuan) at the end of the second quarter of their zodiac year. The levels of cash holdings then begin to decline and the effect vanishes at the conclusion of the zodiac year. The coefficient for the *Post-zodiac qi* variables indicate that the average difference in cash holdings between firms whose chairperson is in a zodiac year and other firms is indistinguishable from zero one year after the chairperson's zodiac year.

Table 2.3 Zodiac proximity and changes in the dynamics of corporate cash holdings

This table presents the OLS estimates of the effects of belief in luck on the level of corporate cash holdings during a chairperson's zodiac year, by quarter. I study the differences in the levels of cash holdings between zodiac and other firms at different points in time before and after the chairperson's zodiac year. The dependent variable is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter. The variables *Pre(Post)-zodiac qi* and *Zodiac qi* are dummies that equal one if the chairperson of the firm in quarter *qi* is in (before/after) his or her zodiac year. All other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability purposes. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: Cash (%)		
	Coef.	t-Statistics
Pre-zodiac q1	0.288	(0.843)

sheet published after this event. The Pre-zodiac q4 shows the change in cash holdings made in reaction to the zodiac year as a precautionary move.

Pre-zodiac q2	0.102	(0.145)
Pre-zodiac q3	-0.093	(-0.303)
Pre-zodiac q4	0.508**	(2.143)
Zodiac q1	0.732**	(2.473)
Zodiac q2	0.766***	(2.702)
Zodiac q3	0.670**	(2.336)
Zodiac q4	0.481*	(1.714)
Post-zodiac q1	0.284	(0.927)
Post-zodiac q2	0.235	(0.435)
Post-zodiac q3	0.079	(0.24)
Post-zodiac q4	-0.294	(-0.78)
Firm and chairperson characteristics controls	Yes	
Firm fixed effects	Yes	
Time fixed effects	Yes	
N	56,708	
Adj. R^2	0.658	

I plot the results of this analysis in Figure 2.2, which shows a distinct increase in cash holdings in the zodiac year relative to other lunar years. This result indicates that the chairperson's reactions to their zodiac year are not due to other time-dependent variables (e.g. age).

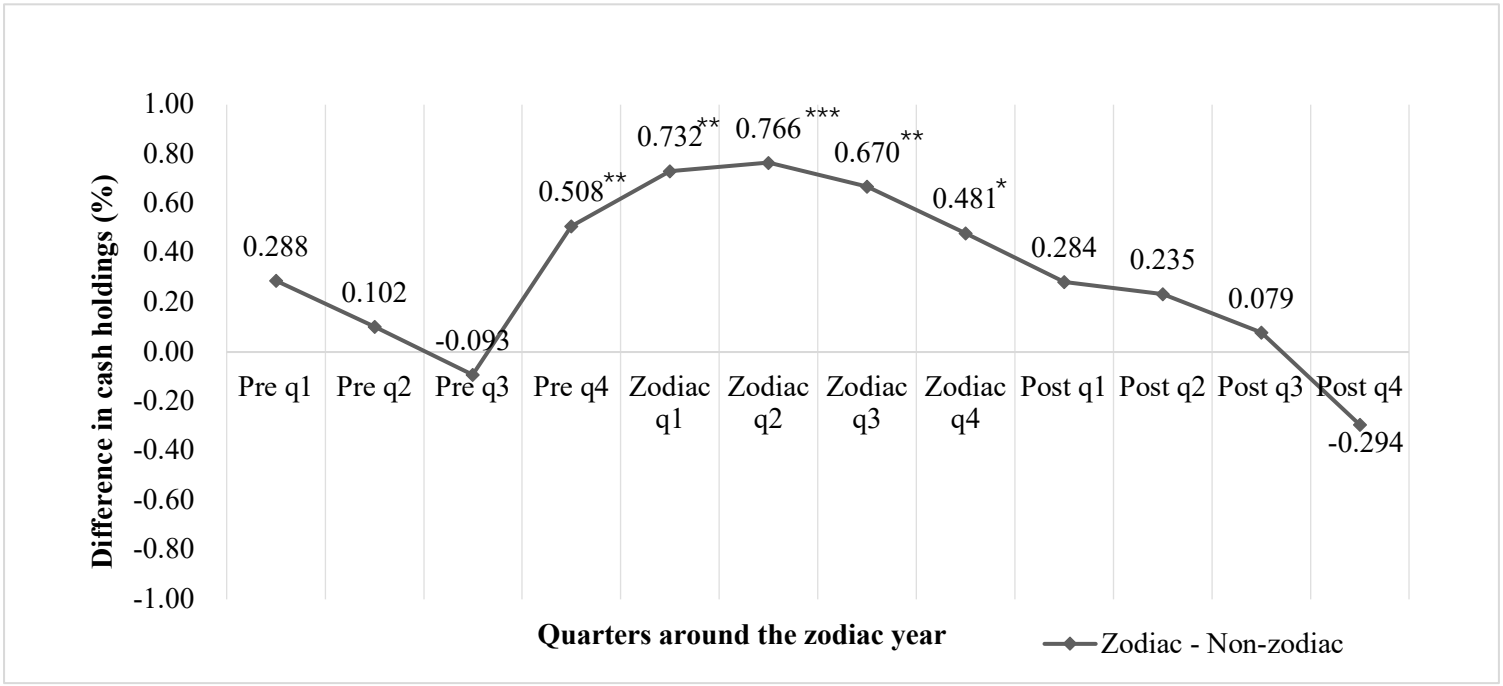

Figure 2.2 Zodiac year proximity and corporate cash holdings

This figure presents the differences in corporate cash holdings across progressive quarters surrounding the chairperson's zodiac year. All the difference estimates use the remainder of the listed firms as the non-zodiac group. The graph plots the regression coefficients from Table 2.3. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The patterns in the changes in levels of cash holdings are consistent with Hypothesis 1. Chairpersons who believe in luck will set aside additional cash before the cusp of the zodiac year as a precautionary measure. As time passes and other pressing needs take centre stage, the perceived probability of risk drops back towards its initial value, at which point these chairpersons reduce corporate cash holdings.

2.5.2 Sources of cash

I posit that possible sources for the increase in cash holdings during a chairperson's zodiac year could derive from earnings retention and/or a decrease in risky investments rather than from the diversion of other resources. To test this hypothesis, I first conduct an OLS regression on operating margins, net working capital (*NWC*), and new financing before applying the mediation model to test the effect of earnings retention as well as risky investments. The literature (Lang *et al.* 2012; Chen *et al.* 2019; Tsang *et al.* 2019) has widely adopted this mediation model to provide direct evidence of underlying financial mechanisms in other settings.

In Table 2.4, I explore whether a chairperson's belief in the adverse fortunes of their zodiac year affects operating activity, operating investment, or financial activity. Column (1) shows that the zodiac year has no effect on operating revenues for those firms whose chairperson is in his or her zodiac year, since they suffer no statistically significant decrease in operating margin. This finding further confirms that the widely held belief in personal misfortunes attributed to the zodiac year does not apply to corporate operating profits. As shown in Table 2.4, I find no evidence that the proximity of the zodiac year modifies either net working capital (column (2)) or new financial activity (column (3)), since none of the coefficients are statistically significant.

Table 2.4 Source of changes in cash holdings due to zodiac year proximity

This table presents the OLS estimates of the effect of the proximity of a chairperson's zodiac year on various outcome variables that affect the level of corporate cash holdings. The variable Zodiac is a dummy equal to one if the chairperson of the firm is in his or her zodiac year. All

other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level, The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Operating margin (%)	NWC (%)	New finance (%)
OLS	(1)	(2)	(3)
Zodiac	0.212	-0.127	-0.080
	(0.689)	(-0.525)	(-0.142)
Age	-0.186***	0.072*	-0.360***
	(-5.551)	(1.852)	(-8.414)
Female	-1.657	-0.826	-0.461
	(-1.198)	(-0.570)	(-0.469)
Education	-1.426***	0.657*	-2.135***
	(-3.588)	(1.791)	(-4.620)
Size	2.834***	1.827***	-1.607***
	(8.753)	(5.217)	(-4.134)
Leverage	-28.941***	-55.971***	-21.327***
	(-15.281)	(-32.311)	(-13.697)
MTB	-0.251***	0.069	-1.521***
	(-2.777)	(0.986)	(-20.313)
Firm fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
N	57,178	56,776	57,204
Adj. R^2	0.467	0.750	0.192

Table 2.5 reports the results of the mediation effect on earnings retention and risky investment. In column (1), the findings from column (3) of Table 2.2 are repeated for the sake of comparison,

thus providing the first-stage result of mediation analysis. As discussed, I report a significantly positive association between levels of cash holdings and the chairperson's zodiac year. Column (2) reports the results of the second-stage mediation analysis. The coefficient of the zodiac variable is negative and significant when I employ *Dividend* as the dependent variable. Therefore, consistent with belief in bad luck, this result suggests that chairpersons retain more earnings in their zodiac years as a buffer against premonitions of personal misfortune.

Table 2.5 Sources of cash in zodiac years

This table presents the results for the mediation effect of earnings retention and risky investments, investigating possible sources for the increase in cash holdings in the chairperson's zodiac year. The heading of each column indicates the dependent variable of the corresponding regression: Cash is the total amount of cash (and cash equivalents) scaled by the total assets of the firm at the end of the quarter; Dividend represents the firm's total dividends over its net income the previous year; R&D is R&D expenditures divided by total revenues; and M&A is the ratio of the total value of the transactions of the firm across all M&A deals over total assets. All other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

		Earning retention		Risky investment			
Dependent variable	Cash (%)	Dividend (%)	Cash (%)	R&D (%)	Cash (%)	M&A (%)	Cash (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	0.655***	-0.252**	0.653***	-0.045**	0.648***	-0.235**	0.647***
	(2.622)	(-1.991)	(2.619)	(-2.353)	(2.611)	(-2.574)	(2.593)
R&D					-17.093***		
					(-3.752)		

Dividend			-0.299**				
			(-2.035)				
M&A							-3.228***
							(-4.766)
Age	-0.280***	0.077***	-0.280***	0.006***	-0.281***	0.016**	-0.280***
	(-8.072)	(4.731)	(-8.062)	(2.792)	(-8.088)	(2.167)	(-8.063)
Female	-1.817	0.074	-1.816	-0.011	-1.760	-0.157	-1.822
	(-1.517)	(0.139)	(-1.515)	(-0.155)	(-1.469)	(-0.586)	(-1.519)
Education	-0.865***	0.134	-0.865***	0.006	-0.867***	0.069	-0.864***
	(-2.630)	(0.881)	(-2.631)	(0.184)	(-2.640)	(0.840)	(-2.628)
Size	-3.662***	0.757***	-3.659***	0.212***	-3.584***	-0.461***	-3.678***
	(-10.562)	(6.749)	(-10.552)	(7.555)	(-10.319)	(-7.301)	(-10.603)
Leverage	-58.136***	-3.018***	-58.153***	-0.265**	-58.395***	-1.173***	-58.161***
	(-28.048)	(-4.982)	(-28.044)	(-2.276)	(-28.183)	(-3.053)	(-28.083)
MTB	-0.893***	0.370***	-0.891***	0.018***	-0.892***	0.396***	-0.880***
	(-12.992)	(10.604)	(-12.950)	(2.896)	(-13.020)	(14.217)	(-12.790)

NWC	-51.293***		-51.272***		-51.424***		-51.253***
	(-30.842)		(-30.832)		(-31.006)		(-30.823)
Cexp	-14.860***		-14.827***		-14.395***		-14.907***
	(-5.527)		(-5.514)		(-5.358)		(-5.544)
CF	50.166***		50.015***		49.239***		50.010***
	(13.950)		(13.871)		(13.706)		(13.917)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	56,708	5,0829	50,378	57,178	56,683	57,204	56,708
Adj. R^2	0.658	0.251	0.658	0.664	0.660	0.026	0.658

In column (3) of Table 2.5, I include both Zodiac and Dividend as testing variables when I use cash holdings as the dependent variable. I find that the dividend payout is negatively correlated to cash holdings, which is consistent with the notion that a reduction in dividend payout serves as the source of the increase in cash holdings. Importantly, although Zodiac remains positively and significantly associated with cash holdings, its coefficient (0.653) is smaller when compared to the corresponding coefficient in column (1) (0.655), which is in line with a partial mediation effect of earnings retention.

I then include R&D expenditures in mediation model. In Table 2.5, column (1) again serves as the first-stage benchmark, while columns (4) and (5) report the second- and third-stage results of the mediation analysis based on R&D expenditures. These results satisfy the requirements of the second- and third-stage regressions for mediation analysis: the negative coefficient on Zodiac in column (4) suggests that chairpersons actively reduce their R&D expenditures in their zodiac years, and the coefficient of Zodiac is smaller in column (5) than it is in column (1), consistent with the partial mediation effect. The same result is obtained for M&A expenditures, as shown in columns (6) and (7).

Overall, these results suggest that chairpersons tend to retain more earnings and reduce risky investments in R&D and M&As to increase cash holdings during their zodiac year.

2.5.3 Value of cash

In Table 2.6, I analyse the marginal value of a firm's cash during the chairperson's zodiac year. In column (1), I control for firm and time fixed effects. The coefficient of the change in cash holdings in column (1) indicates that, when cash holdings increase by one yuan, the market value increases by approximately 0.47 RMB in a non-zodiac year. Column (1) also shows that the increase in market value is significantly smaller when cash holdings increase because of the proximity of the zodiac year. The coefficient of the interaction term between the zodiac year and the change in cash holdings shows that an increase of one yuan in cash holdings for both firms with a chairperson in his or her zodiac year and other firms leads to a smaller increase in

market value for the former, for a loss of 0.1 yuan in market value relative to other firms. This discount for each additional yuan in cash suggests that shareholders view this extra cash as wasteful, thereby confirming that the chairperson's decision to increase cash holdings is deemed suboptimal. In column (2), I control for chairperson age cohort fixed effects. The zodiac year indicator is stable in this specification.

Table 2.6 Change in the value of cash holdings in the chairperson's zodiac year

This table presents the OLS estimates of the effect of the proximity of the chairperson's zodiac year on the marginal value of corporate cash holdings. The dependent variable is the change in equity market value over the quarter, scaled by the equity market value. The change in cash is the change in corporate cash holdings over the quarter, scaled by the equity market value. The variable Zodiac is a dummy equal to one if the chairperson of the firm is in his or her zodiac year. I estimate the marginal value of cash over the whole sample using the specifications laid out by Faulkender and Wang (2006) and Dessaint and Matray (2017). Controls include changes in earnings, interest, dividends, net assets, R&D, market leverage, new financing, lagged cash, and interaction terms. All other variables are as defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable: ΔMV				
	(1)		(2)	
	Coef.	t-Statistics	Coef.	t-Statistics
Zodiac	-0.008*	(-1.661)	-0.008*	(-1.684)
ΔCash	0.471***	(12.537)	0.474***	(12.603)
Zodiac × ΔCash	-0.101**	(-1.961)	-0.104**	(-2.021)
Age	-0.002***	(-5.200)		

Female	-0.021	(-1.624)	-0.016	(-1.193)
Education	-0.017***	(-4.783)	-0.017***	(-4.714)
Cash	0.219***	(25.015)	0.221***	(25.349)
ΔInterest	0.511	(0.071)	0.562	(0.078)
ΔRD	1.641	(1.207)	1.756	(1.290)
ΔNA	0.249***	(13.501)	0.250***	(13.549)
ΔEarnings	0.353***	(7.632)	0.353***	(7.633)
ΔDividend	-0.527***	(-6.652)	-0.524***	(-6.610)
New finance	-0.319***	(-18.809)	-0.320***	(-18.724)
Leverage	-0.067***	(-4.701)	-0.069***	(-4.896)
ΔCash × Cash	0.138***	(5.941)	0.141***	(6.021)
Leverage × ΔCash	-0.414***	(-6.385)	-0.419***	(-6.450)
Age cohort fixed effects			Yes	
Firm fixed effects	Yes		Yes	
Time fixed effects	Yes		Yes	
N	52,294		52,294	
Adj. R^2	0.024		0.024	

Overall, these results show that the decision to temporarily hoard cash during a chairperson's zodiac year negatively impacts firm value by reducing the value of cash.

2.5.4 Test of SOEs

In this section, I further examine the belief in the bad luck effect during zodiac years for SOEs. In Table 2.7, I show the results of placebo test focused on SOEs. In contrast to non-SOEs, whose chairpersons generally represent their own financial interests as controlling shareholders, in SOEs the chairperson represents the interests of (and takes instructions from) the government. An SOE chair thus serves a more custodial role in carrying out the government's wishes. Hence, I may assume that chairperson characteristics (including their zodiac year status) are less plausibly relevant to their firms' liquidity policies. Consistent with this view, I find no correlation between the SOE chairpersons' zodiac year status and their cash holdings, as shown in Table 2.7.

Table 2.7 Zodiac year proximity and cash holdings in the SOE sample

This table presents the OLS estimates of the effects of the belief in bad luck during a chairperson's zodiac year on the level of corporate cash holdings in the SOE sample. The dependent variable is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter, and Zodiac is a dummy variable equal to one if the chairperson of the firm is in his or her zodiac year. All other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable: Cash (%)			
	(1)	(2)	(3)	(4)
Zodiac	-0.044	-0.082	-0.141	-0.138
	(-0.214)	(-0.388)	(-0.735)	(-0.723)
Age		-0.041	-0.013	
		(-1.453)	(-0.476)	
Female		0.962	0.559	0.570
		(0.954)	(0.589)	(0.597)

Education		-0.468**	-0.262	-0.225
		(-2.011)	(-1.155)	(-1.008)
Size			0.290	0.270
			(0.997)	(0.947)
Leverage			-27.509***	-27.451***
			(-15.210)	(-15.219)
MTB			-0.215***	-0.218***
			(-3.562)	(-3.601)
NWC			-26.793***	-26.802***
			(-15.917)	(-15.906)
Cexp			-6.890**	-6.846**
			(-2.323)	(-2.305)
CF			44.144***	44.270***
			(13.056)	(13.097)
Age cohort fixed effects				Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	45,985	44,081	42,356	42,356
Adj. R^2	0.589	0.586	0.653	0.653

2.5.5 Robustness check

More controls

In this section, I cover a number of additional robustness tests. In Table 2.8, I investigate whether the increase in corporate cash holdings documented above remains robust after applying further controls.

First, I use industry and time fixed effects to remove anomalous trends in different industries and find that they do not alter my estimation (column（1) of Panel A in Table 2.8). The impact of zodiac year belief on corporate cash holding also remains robust when the chairperson's birth

year is controlled for by adding chairperson birth year fixed effects (column (2)). Furthermore, according to the results in column (3), the zodiac year belief effect observed remains robust after the nonlinear effect of the chairperson's age on corporate cash holdings is controlled for. In Panel B of Table 2.8, I add more variables, including the chairperson's level of academic attainment, experience, and gender, and their interaction terms with the zodiac year variable as controls. I do so because these are all factors that may affect a chairperson's managerial decisions, such as those involving cash holdings (MacCrimmon & Wehrung 1990; Huang & Kisgen 2013; Bernile *et al.* 2017; Dessaint & Matray 2017; Feng & Johansson 2018). I add each of these factors progressively to my model in order to test the robustness of the relation between the zodiac year and corporate cash holdings.

Table 2.8 Robustness check: Further controls

This table presents the results of additional tests to determine whether the effects of zodiac year proximity on the main variable outcomes are robust to alternative specifications. In Panel A, the dependent variable is the total amount of cash and cash equivalents scaled by total assets at the end of the quarter. In Panel B, I add controls for the chairperson's personal sophistication and their interaction term with the zodiac year variable. Variables measuring the chairperson's degree of sophistication include the possession of a bachelor's degree, overseas experience, trauma experience (a dummy variable indicating whether the chairperson has lived through a traumatic experience such as a famine), and being female. The control variables are the same for the baseline regressions, and education is omitted in column (1) of Panel B. All other variables are as defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A:
Dependent variable: Cash (%)

	Industry and time fixed effects (1)		Chairperson's birth year fixed effects (2)		Nonlinear age effect (3)	
	Coef.	t-Statistic	Coef.	t-Statistic	Coef.	t-Statistic
Zodiac	0.654***	(2.613)	0.662***	(2.618)	0.647***	(2.589)
Age	-0.280***	(-8.034)			0.017	(0.071)
Age^2					-0.003	(-1.233)
Female	-1.802	(-1.499)	-0.867	(-0.707)	-1.731	(-1.441)
Education	-0.859***	(-2.605)	-0.321	(-0.943)	-0.903***	(-2.731)
Size	-3.672***	(-10.581)	-4.364***	(-13.010)	-3.641***	(-10.451)
Leverage	-58.025***	(-27.887)	-57.853***	(-28.256)	-58.238***	(-28.205)
MTB	-0.893***	(-12.945)	-0.961***	(-13.904)	-0.89***	(-12.938)
NWC	-51.159***	(-30.632)	-51.77***	(-31.394)	-51.314***	(-30.926)
Cexp	-14.530***	(-5.310)	-14.268***	(-5.299)	-15.057***	(-5.600)
CF	50.994***	(13.888)	52.836***	(14.582)	50.190***	(13.961)
Firm fixed effects	Yes		Yes		Yes	
Time fixed effects			Yes		Yes	
Industry and time fixed effects	Yes					
Chairperson birth year fixed effects			Yes			
N	56,708		56,708		56,708	
Adj. R^2	0.657		0.656		0.658	

Panel B: Control for the chairperson's sophistication				
Dependent variable: Cash (%)				
	Educational background	Past experience		Gender
	(1)	(2)	(3)	(4)
Zodiac	1.268**	0.585**	0.898***	0.552**
	(2.327)	(2.267)	(2.747)	(0.2556)
Bachelor	-2.451***			
	(-2.981)			
Zodiac × Bachelor's	-0.764			
	(-1.249)			
Overseas experience		-0.906		
		(-1.080)		
Zodiac × Overseas experience		1.079		
		(0.991)		
Trauma experience			6.544***	
			(5.628)	
Zodiac × Trauma experience			-0.630	
			(-1.215)	
Female				1.902
				(1.612)
Zodiac × Female	-1.750	-1.780	-1.655	-1.965
	(-1.448)	(-1.485)	(-1.364)	(-1.634)
Firm and chairperson characteristics controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes

N	56,708	56,708	56,708	56,708
Adj. R^2	0.658	0.658	0.661	0.658

I investigate the education effect by conducting baseline regression (1) with the interaction term between the zodiac and bachelor's degree variables. The results of this analysis are reported in column (1) of Panel B in Table 2.8. I found no significant reduction of the zodiac year effect.

To test whether an increase in cash holdings during a chairperson's zodiac year depends on experience, I also include interaction terms between the variables for zodiac and overseas experience (column (2)) and trauma experience[12] (column (3)), respectively, in my baseline regression (1). Column (2) of Panel B in Table 2.8 shows that past overseas experience has no effect on the relation between belief in luck and corporate cash holdings, while column (3) further shows that the relation is unaffected by a chairperson's reported experience of trauma. Moreover, as shown in column (4) of Panel B in Table 2.8, whether managers are female or male has no significant impact upon the relation between the zodiac year and corporate cash holdings. Taken together, then, the results in Panel B of Table 2.8 indicate that the relation between a chairperson's zodiac year and corporate cash holdings is robust to and not moderated by the chairperson's personal characteristics, including education, experience, and gender.

An alternative measure of cash holdings

I also check that my results pertaining to cash over total assets are robust to an alternative measurement of cash holdings by applying my main analysis on the ratio of cash to net assets.

[12] The trauma experience indicates the individual's experience of the Great Chinese Famine, which took place from 1959 to 1961. Due to the severe shortage of food, approximately 30 million (Li & Yang 2005) died during those years. As a comparison, this is far more than the nine million combatants and seven million civilians who died during World War I. Feng and Johansson (2018) found that one's experience of the famine is associated with more conservative managerial behaviour.

Table 2.9 shows that the zodiac year effect remains significant regardless of the measurement of cash holdings.

Table 2.9 Robustness check: Alternative measurements of cash

This table presents additional tests to determine whether the effects of zodiac year proximity on the main variable outcomes are robust to an alternative measurement of cash holdings. The dependent variable is an alternative measure of cash holdings, specifically the total amount of cash and cash equivalents scaled by total assets net corporate cash at the end of each quarter. The control variables are the same as in my baseline model. All other variables are as defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable: NCash (%)			
	(1)	(2)	(3)	(4)
Zodiac	2.287**	1.804*	1.595**	1.801**
	(2.297)	(1.824)	(1.975)	(2.218)
Age		-1.671***	-0.821***	
		(-12.642)	(-8.332)	
Female		-7.614*	-4.494	-3.193
		(-1.760)	(-1.412)	(-1.010)
Education		-8.076***	-2.359**	-1.325
		(-7.471)	(-2.484)	(-1.436)
Size			-9.438***	-10.294***
			(-9.370)	(-10.426)
Leverage			-150.345***	-150.057***
			(-23.860)	(-23.852)
MTB			-2.699***	-2.792***

			(-13.166)	(-13.476)
NWC			-144.070***	-144.646***
			(-25.813)	(-25.710)
Cexp			-85.602***	-83.864***
			(-10.388)	(-10.179)
CF			102.571***	106.077***
			(9.188)	(9.428)
Age cohort fixed effects				Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
N	63,760	59,922	56,708	56,708
Adj. R^2	0.374	0.403	0.596	0.594

PSM

I also combine my regression approach with a matching approach to alleviate any risk of bias introduced by the linear settings of my regression model. I create two data samples comparable across all of the control variables, differing only in terms of whether the chairperson is in his or her zodiac year. To construct these samples, I implement a PSM process following Drucker and Puri (2005) and match firms whose chairpersons are in their zodiac year with firms of similar characteristics whose chairperson is not in a zodiac year. More specifically, the method comprises a probit regression to estimate propensity scores, p(Y = 1/X = x), based on the probability of receiving a binary treatment Y conditional on all the control variables x. In mu setting, I view chairpersons in their zodiac year as the treated, and I estimate the probability of a chairperson being in a zodiac year by using the independent variables based on specification (3) of Table 2.2. Then, for each firm-year-quarter with a zodiac year chairperson, I use the propensity score to identify a comparable firm-year-quarter with a non–zodiac year chairperson based on the nearest-neighbour method.

To ensure the adequacy of the matching estimation method, I require that the absolute difference in propensity scores among pairs not exceed 0.05. If there are more firm-year-quarters with a non-zodiac year chairperson that meet this criterion, then I retain those firm-year-quarters with the smallest differences in propensity scores. Using this approach, I find 4,890 unique pairs of matched firm-year-quarters.

Panel A of Table 2.10 reports the differences in the means of the independent variables for zodiac year and non-zodiac year chairpersons for the matched sample. The *t*-statistics of the corresponding differences in means indicate that almost all the independent variables are comparable to the matched sample. Using this matched sample in Panel B, I rerun the regressions as shown in columns (3) and (4) of Table 2.2. The results remain robust, reaffirming that the zodiac year effect is not an artefact of any functional form misspecification bias.

Table 2.10 Robustness check: Propensity score matching

Panel A presents the differences in means between subsamples of firms with zodiac year and non-zodiac year chairpersons, together with the corresponding t-statistics for each control variable presented in Table 2.2. The matched sample is based on chairperson zodiac year PSM. Panel B presents coefficient estimates of specifications (3) and (4) of Table 2.2 for the matched sample. The dependent variable is the total amount of cash (and cash equivalents) scaled by the total assets of the firm at the end of the quarter, and Zodiac is a dummy variable equal to one if the chairperson of the firm is in his or her zodiac year. All other variables are as defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. Standard errors are clustered at the firm level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A		
	Matched sample	
	Difference in means	t-Statistics

Age	-2.3	(-1.16)
Female	-1.4	(-0.68)
Education	1.7	(0.85)
Size	2.9	(1.45)
Leverage	2.2	(1.08)
MTB	1.4	(0.76)
NWC	-2.4	(-1.18)
Cexp	-1.6	(-0.8)
CF	-1.6	(0.82)
Entire sample	9,780	
Zodiac-year sample	4,890	
Non-zodiac year sample	4,890	

Panel B

Dependent variable: Cash (%)

	(1)		(2)	
	Coef.	t-Statistics	Coef.	t-Statistics
Zodiac	0.838***	(2.635)	0.835***	(2.622)
Age	-0.231***	(-4.601)		
Female	-1.707	(-0.946)	-1.164	(-0.662)
Education	-0.528	(-1.046)	-0.371	(-0.735)
Size	-3.476***	(-7.778)	-3.651***	(-8.324)
Leverage	-60.313***	(-19.207)	-60.557***	(-19.228)
MTB	-1.199***	(-12.401)	-1.221***	(-12.588)
NWC	-54.990***	(-22.349)	-55.235***	(-22.395)

Cexp	-12.113**	(-2.548)	-11.919**	(-2.516)
CF	44.678***	(7.659)	45.555***	(7.822)
Age cohort fixed effects			Yes	
Firm fixed effects	Yes		Yes	
Time fixed effects	Yes		Yes	
N	9780		9780	
Adj. R^2	0.735		0.734	

2.6

2.7 Conclusion

This paper provides empirical evidence that managers exhibit biases when assessing risk. I show that managers temporarily increase the amount of corporate cash holdings as a result of a biased risk perception caused by an irrational premonition of bad luck. Such a reaction cannot be viewed as rational, even given prevailing uncertainties, since the real liquidity risks are not necessarily greater during a chairperson's zodiac year. Rather, this reaction is consistent with the theory of belief in luck (Darke & Freedman 1997; Damisch *et al.* 2010), which predicts that a belief in bad luck will tend to make managers overestimate the probability of a negative outcome, even though its actual probability remains unchanged.

More importantly, I show that such aberrant judgement is suboptimal and inefficient in terms of resource allocation and shareholder value. Financial managers tend to retain cash from earnings and by reducing their levels of risky investments in such areas as R&D and M&A expenditures, thus inducing shareholder loss. I also provide evidence suggesting that the relation between belief in luck and cash holdings during a chairperson's zodiac year is robust to a variety of controls, including the type of firm, the industry, and the chairperson's demographic characteristics.

Overall, results shown in this chapter indicate that the cash holding increase in chairman zodiac year is caused by the manager's superstitious belief about bad luck and leads to deterioration

of firm value of cash. In this case, the economic impact of zodiac year is significant to firm's shareholders.

My findings contribute to our general understanding of how cognitive bias influences managerial decisions. In this paper, I show that corporate liquidity policy is adversely affected by a chairperson's belief in luck, which ultimately harms firm value. Given the large and increasing diversity of risks that must be assessed daily by the key decision makers of companies, my results suggest that the economic cost of this bias could be considerable.

My results also have important implications for the literature on investors' attitudes towards luck and portfolio allocation. Examining the relation between an investor's zodiac year and risk taking may prove to be an equally promising endeavour for future research.

2.8 Appendix A: Variable definitions

Age	The age of the chairperson.
Cash	Cash and cash equivalents scaled by total assets.
Cexp	Capital expenditure scaled by total assets.
CF	Net earnings scaled by total assets.
Education	Indicator of the board chair's educational attainment, where 1 denotes senior middle school or lower, 2 a junior college degree, 3 a bachelor's degree, 4 a master's degree, and 5 a doctoral degree.
Female	Dummy variable indicating whether the chairperson is female.
Bachelor	Dummy variable indicating whether the chairperson attained a bachelor's degree or above.
Dividend	Total dividends over last year's net income.
Oversea experience	Dummy variable indicating whether the chairperson has overseas experience.
Trauma experience	Dummy variable indicating whether the chairperson experienced the Great Chinese Famine.
Cash	Cash and cash equivalents scaled by total asset at the end of each quarter.
NCash	Cash and cash equivalents scaled by net total asset (total asset minus cash and cash equivalents) at the end of each quarter.
Leverage	Ratio of total debt to total assets.
M&A	Ratio of the total value of the transactions the firm makes in M&A deals over total assets.
MTB	Market capitalisation over total equity.
New finance	Issuance of long-term debt plus the sale of new stocks scaled by equity market value.
NWC	Net working capital, i.e. current assets (less cash) minus current liabilities over total assets.
Operating margin	Operating income after depreciation over total revenues.

R&D	R&D expenditure over total revenues.
Size	Natural logarithm of total assets.
Zodiac	Dummy variable that equals one if the chairperson of the firm is in his or her zodiac year, and zero if not.
ΔCash	Change in cash and cash equivalents scaled by total assets.
ΔEarnings	Change in net income before extraordinary items scaled by market value.
ΔInterest	Change in interest expenses scaled by market value.
ΔMV	Change in equity market value over the quarter scaled by the equity market value for the previous quarter.
ΔNA	Change in total assets minus all cash and cash equivalents scaled by the market value.
ΔDividend	Change in dividends scaled by the market value.
ΔNWC	Change in net working capital scaled by market value.
ΔRD	Change in R&D expenses (set to zero if not applicable) scaled by the market value.

2.9 Appendix B: Standard errors of different types

Table B.1: Standard errors of different types in baseline model

This table presents the replication of baseline model with different types of error terms. The dependent variable is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter, while Zodiac is a dummy variable equal to one if the chairperson of the firm is in his or her zodiac year. All other variables are defined as in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. In Panel A, I use robust standard errors. In Panel B, error terms are clustered at the industry level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A:

	Dependent variable: Cash (%)			
	(1)	(2)	(3)	(4)
Zodiac	0.863***	0.737***	0.655***	0.717***
	(4.600)	(3.907)	(4.513)	(4.920)
Age		-0.610***	-0.280***	
		(-42.391)	(-24.132)	
Female		-2.971***	-1.817***	-1.335***
		(-5.465)	(-4.321)	(-3.227)
Education		-3.076***	-0.865***	-0.557***
		(-22.970)	(-7.132)	(-4.664)
Size			-3.662***	-3.925***
			(-35.488)	(-38.782)
Leverage			-58.136***	-58.110***
			(-83.474)	(-83.221)
MTB			-0.893***	-0.921***
			(-32.209)	(-33.060)
NWC			-51.293***	-51.498***
			(-89.094)	(-89.113)

Cexp			-14.860***	-14.400***
			(-10.077)	(-9.765)
CF			50.166***	51.288***
			(27.170)	(27.664)
Age cohort fixed effects				Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	63,763	59,925	56,708	56,708
Adj. R^2	0.407	0.439	0.658	0.656

Panel B:				
	Dependent variable: Cash (%)			
	(1)	(2)	(3)	(4)
Zodiac	0.863***	0.737***	0.655**	0.717**
	(3.411)	(2.646)	(2.269)	(2.519)
Age		-0.610***	-0.280***	
		(-8.891)	(-10.446)	
Female		-2.971*	-1.817	-1.335
		(-1.740)	(-1.173)	(-0.870)
Education		-3.076***	-0.865**	-0.557
		(-5.993)	(-2.323)	(-1.534)
Size			-3.662***	-3.925***
			(-4.656)	(-4.900)
Leverage			-58.136***	-58.110***
			(-13.221)	(-13.008)
MTB			-0.893***	-0.921***
			(-9.756)	(-9.993)
NWC			-51.293***	-51.498***
			(-13.617)	(-13.480)

Cexp			-14.860***	-14.400***
			(-5.038)	(-4.981)
CF			50.166***	51.288***
			(12.653)	(13.001)
Age cohort fixed effects				Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	63,763	59,925	56,708	56,708
Adj. R^2	0.407	0.439	0.658	0.656

Table B.2: Standard errors of different types in the mediation effect model

In this table, I replicate my mediation effect model with different types of error terms. The variable in the heading of each column is the dependent variable of the corresponding regression: Cash is the total amount of cash and cash equivalents scaled by the total assets of the firm at the end of the quarter; Dividend represents total dividends over the last year's net income; R&D is R&D expenditures divided by total revenues; and M&A is the ratio of the total value of a firm's transactions across all M&A deals over total assets. All other variables are defined in Appendix A. All continuous variables are winsorised at the first and 99th percentiles. All regression coefficients are multiplied by 100 for readability. In Panel A, I use robust standard errors. In Panel B, the error terms are clustered at the industry level. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Regression with robust standard errors

		Earning retention		Risky investment			
Dependent variables	Cash (%)	Dividend (%)	Cash (%)	R&D (%)	Cash (%)	M&A (%)	Cash (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	0.655***	-0.252**	0.653***	-0.045***	0.648***	-0.235**	0.647***
	(4.513)	(-2.271)	(4.508)	(-3.095)	(4.485)	(-2.560)	(4.462)
R&D			-0.299**				
			(-2.072)				

Dividend					-17.093***		
					(-9.090)		
M&A							-3.228***
							(-4.601)
Age	-0.280***	0.077***	-0.280***	0.006***	-0.281***	0.016**	-0.280***
	(-24.132)	(4.881)	(-24.107)	(6.361)	(-24.325)	(2.085)	(-24.100)
Female	-1.817***	0.074	-1.816***	-0.011	-1.760***	-0.157	-1.822***
	(-4.321)	(0.132)	(-4.318)	(-0.325)	(-4.181)	(-0.552)	(-4.329)
Education	-0.865***	0.134	-0.865***	0.006	-0.867***	0.069	-0.864***
	(-7.132)	(0.893)	(-7.135)	(0.532)	(-7.155)	(0.800)	(-7.127)
Size	-3.662***	0.757***	-3.659***	0.212***	-3.584***	-0.461***	-3.678***
	(-35.488)	(7.215)	(-35.455)	(23.623)	(-34.815)	(-6.774)	(-35.616)
Leverage	-58.136***	-3.018***	-58.153***	-0.265***	-58.395***	-1.173***	-58.161***
	(-83.474)	(-4.801)	(-83.452)	(-5.818)	(-84.951)	(-3.090)	(-83.531)
MTB	-0.893***	0.370***	-0.891***	0.018***	-0.892***	0.396***	-0.880***
	(-32.209)	(10.291)	(-32.115)	(6.928)	(-33.042)	(15.208)	(-31.623)
NWC	-51.293***		-51.272***		-51.424***		-51.253***

	(-89.094)		(-89.101)		(-90.423)		(-89.031)
Cexp	-14.860***		-14.827***		-14.395***		-14.907***
	(-10.077)		(-10.055)		(-9.789)		(-10.106)
CF	50.166***		50.015***		49.239***		50.010***
	(27.17)		(27.048)		(26.905)		(27.105)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,708	50,829	50,378	57,178	56,683	57,204	56,708
Adj. R^2	0.658	0.251	0.658	0.664	0.660	0.026	0.658

Panel B: Regression with errors clustered at industry level

Dependent variables		Earning retention		Risky investment			
	Cash (%)	Dividend (%)	Cash (%)	R&D (%)	Cash (%)	M&A (%)	Cash (%)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

Zodiac	0.655**	-0.252**	0.653**	-0.045**	0.648**	-0.235**	0.647**
	(2.269)	(-1.963)	(2.263)	(-2.042)	(2.233)	(-2.440)	(2.241)
R&D					-17.093***		
					(-2.681)		
Dividend			-0.299**				
			(-2.012)				
M&A							-3.228***
							(-4.573)
Age	-0.280***	0.077***	-0.280***	0.006***	-0.281***	0.016***	-0.280***
	(-10.446)	(4.731)	(-10.428)	(3.068)	(-10.527)	(2.835)	(-10.428)
Female	-1.817	0.074	-1.816	-0.011	-1.760	-0.157	-1.822
	(-1.173)	(0.139)	(-1.172)	(-0.210)	(-1.131)	(-0.572)	(-1.176)
Education	-0.865**	0.134	-0.865**	0.006	-0.867**	0.069	-0.864**
	(-2.323)	(0.881)	(-2.324)	(0.242)	(-2.312)	(0.853)	(-2.323)
Size	-3.662***	0.757***	-3.659***	0.212***	-3.584***	-0.461***	-3.678***
	(-4.656)	(6.749)	(-4.651)	(4.064)	(-4.479)	(-5.400)	(-4.685)
Leverage	-58.136***	-3.018***	-58.153***	-0.265*	-58.395***	-1.173***	-58.161***

	(-13.221)	(-4.982)	(-13.213)	(-1.925)	(-13.282)	(-3.054)	(-13.228)
MTB	-0.893***	0.370***	-0.891***	0.018***	-0.892***	0.396***	-0.880***
	(-9.756)	(10.604)	(-9.700)	(2.878)	(-9.724)	(10.004)	(-9.604)
NWC	-51.293***		-51.272***		-51.424***		-51.253***
	(-13.617)		(-13.614)		(-13.749)		(-13.580)
Cexp	-14.860***		-14.827***		-14.395***		-14.907***
	(-5.038)		(-5.024)		(-5.094)		(-5.085)
CF	50.166***		50.015***		49.239***		50.010***
	(12.653)		(12.486)		(12.568)		(12.639)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	56,708	50,829	50,378	57,178	56,683	57,204	56,708
Adj. R^2	0.658	0.251	0.658	0.664	0.660	0.026	0.658

Chapter 3: State Ownership and Post-M&A Innovation Activities: Evidence from Acquirers in China

3.1 Introduction

Innovation has become the dominant force in economic growth and corporate development. For example, the rivalry between the US and China constitutes not just a trade war but a race to the next stage of innovation, technology, and industrial revolution. A firm can achieve innovation improvement through both a series of knowledge-enhancing investments and the acquisition of external knowledge bases (Cohen & Levinthal 1989; Huber 1991; Ahuja & Katila 2001). Based on this presumption, a growing number of studies have attempted to evaluate to what extent the acquirer could improve innovation performance through merger and acquisitions, which is a way to obtain external knowledge bases (Cassiman *et al.* 2005; Cloodt *et al.* 2006; Choi & Sethi 2010; Bena & Li 2014; McCarthy & Aalbers 2016; Cefis & Marsili 2019). According to the literature, factors related to the acquirer's resources, capacity to integrate, and innovation orientation contribute to the post-M&A innovation performance.[13]

While factors related to merging firms in the developed market have been studied extensively in the literature on post-M&A innovation, relatively little research has focused on the factors that are unique to the firms in the emerging markets. Given the great volume of M&A deals in emerging markets (Aguilera & Jackson 2003) and the organisational and behavioural differences between firms in emerging markets and developed markets, it is necessary to consider how key institutional factors in emerging economies shape the post-M&A innovation performance of firms. In this study, therefore, due to the unique institutional setting and the critical role that government plays in affecting firm behaviour, I examine the impact of firms' state ownership on post-M&A innovation performance in China. Specifically, w attempt to analyse the effect of state ownership of acquirers on the pre/post-acquisition change as to the innovation activity in China. I primarily analyse two aspects of innovation performance: innovation inputs proxied by R&D spend relative to assets and innovation output proxied by successful new patent applications. Studying the effect on both dimensions allows us to distinguish

[13] Factors related to the acquirers' resources include acquirers' financial constraint, policy support, and tax support, etc. (Desyllas & Hughes 2010; Yang *et al.* 2019), while factors related to the capacity to integrate include technological similarity, resource complementarity, and stakeholder orientation (Ahuja & Katila 2001; Cassiman *et al.* 2005; Cloodt *et al.* 2006; Cefis & Marsili 2019). In terms of the orientation, Cassiman *et al.* (2005) argue that orientation, skills, language, and cognitive structures facilitate communication and learning.

innovation input from output and to examine the extent to which both are affected by the same acquisition event.

There are two main channels through which state-owned (SOE) acquirers can outperform private-owned (POEs) acquirers in terms of innovation. First, SOE acquirers enjoy superior resources provided by the government than POE acquirers. Indeed, SOEs in China have preferential access to financial capital (Choi *et al.* 2011; Zhou *et al.* 2015), benefit from favourable government policies (such as industry license and market entry barriers) (Zhou *et al.* 2015), and command dominant status in the takeover competition against POE firms through government intervention (Wang *et al.* 2011). These resources allow SOE acquirers to invest more in R&D investment after the M&A and integrate the merging firms to develop innovation. Second, SOE acquirers are likely to integrate well with the target firm, facilitating the following knowledge-base integration and hence the innovation performance. The goals of SOEs are to ensure social stability and to further the interests of society (see Dong *et al.* (2014) as well as Liu and Anbumozhi (2009)), thus gaining them support from the stakeholders during the process. Meanwhile, the business networking of SOE acquirers with preferential access to production inputs and the smoothing of regulatory processes (Sun 2002) enables them to compete for the right target and hence reduce the risk of post-acquisition integration. Therefore, I hypothesise that SOE acquirers would achieve better post-acquisition innovation performance in the form of an increase in both R&D expenditure and the number of new patent registrations.

I further consider the effect of the interaction between the acquirer's innovation orientation and state ownership on the post-M&A innovation performance because the orientation of the corporate activity directly influences the corporate innovation pattern (Jansen *et al.* 2006; Stock & Zacharias 2011). In particular, I focus on the corporate responsible innovation orientation, which has been favourable to society in recent years. The concept of responsible innovation was first introduced by the European Union's Framework Programmes in 2010. In China, the 'Circular of the State Council on Issuing the National Scientific and Technological Innovation planning for the 13th Five Years' also encourages firms to engage in responsible innovation. Responsible innovation, which is different from technology-driven innovation or profit-pull innovation,[14] requires that both innovation process and outcome are ethically acceptable, sustainable, socially desirable, safe for the environment and human health, and that they satisfy the interest of related stakeholders (Von Schomberg 2013). The orientation of responsible innovation is the right impact on society (Owen *et al.* 2012). Firms with responsible innovation orientation invest more in exploring new knowledge and solving non-routine problems, which is risky and time-consuming (Uotila *et al.* 2009). In terms of the SOE acquirers, though they

[14] These are two innovation types that are more prevalent in private-owned enterprises (POEs) and in the US market (see Abernathy and Chakravarthy (1979) for details).

have more favourable resources and a greater capacity than POE acquirers, the post-M&A innovation pattern (both input and output) of SOE acquirers is likely to be differentiated by the responsible innovation orientation. Therefore, I argue that responsible innovation orientation shapes SOEs' post-acquisition innovation pattern.

Finally, I discussed the value creation of acquisitions announced by RIOSOEs in the Chinese market. In line with the prediction of stakeholder theory, the market reacts negatively to the acquisition announcement of RIOSOEs. Nevertheless, in the long term, RIOSOE acquirers will outperform other acquirers.

My research contributes to the literature in several ways. First, by examining the post-acquisition innovation activities of SOEs compared to those of private-owned enterprises (POEs), I provide strong support for the argument that state ownership drives post-acquisition innovation in terms of both R&D investment and patent publications. This aligns with the views of studies (Kole & Mulherin 1997) in which the positive influence of state ownership on corporate performance is reported and extends into the area of M&A-related innovation activities and performance. Second, by examining SOE acquirers with responsible innovation orientation, I contribute to the understanding of the conditions that shape the relationship between M&A and innovation activities. More specifically, I investigate this relationship in an alternative context to earlier studies. In previous M&A and innovation research, knowledge relatedness and product market relatedness are considered to be important factors in explaining the difference in post-acquisition innovation performance between merged enterprises (Cassiman *et al.* 2005; Bena & Li 2014). I extend this stream of studies to empirically demonstrate that responsible innovation orientation differentiates the post-acquisition innovation activities and performance for Chinese SOEs. Third, by differentiating responsible-oriented innovation from other firms I supplement the existing literature on the relationship between Chinese state ownership and government intervention on firm innovation efficiency (Guan & Yam 2015; Boeing 2016; Rong *et al.* 2017). Prior literature considers the aggregate innovation activity of firms and documents a negative effect of state ownership or government intervention on innovation productivity, without considering the innovation orientation. I extend this stream of studies in order to demonstrate the positive role played by state ownership in responsible innovation and performance through M&A. Fourth, by employing different innovation characteristics (R&D investment and patent counts) in my analysis, I build on previous findings by showing that the increase of R&D investment following mergers and acquisitions is likely to occur in SOEs with responsible innovation orientation, whereas the increase of patent counts subsequent to mergers and acquisitions is often observed in other SOEs. Fifth, by drawing attention to the post-acquisition market and operational performance of RIOSOE acquirers, I provide insight into how SOE acquirers with/without responsible innovation orientation impact shareholders' value following M&A in both the short and long term.

The remainder of this paper is organised as follows. In Section 2, I outline the relevant theoretical framework and develop my hypothesis. In Section 3, I describe my empirical methodology and the construction of key variables before providing a sample overview. In Section 4, I report the empirical results. A discussion and conclusion are then presented in Section 7 and Section 8, respectively.

3.2 Literature review and hypothesis development

3.2.1 M&A and innovation performance

Findings in the literature regarding the impact of M&A on innovation activity (e.g. R&D activities and patent generation) remain inconclusive. Some argue that the combination of two entities could improve the innovation of the engaging entities (Bena & Li 2014), while others report a negative effect of M&A on the innovation in merging enterprises (Cassiman *et al.* 2005).

Reasons supporting the positive effect of M&A on innovation activity are listed below. First, one could expect an increase in R&D activities as the result of economies of scale and scope after merger and acquisition (Cockburn & Griliches 1987; Caves 1989; Henderson & Cockburn 1994). After merger and acquisition, the scale of the R&D process is likely to be enlarged. Moreover, the merging enterprise will try to combine the R&D process by reorganising the R&D personnels knowledge, and projects, leading to higher output. With the economies of scale in R&D activity, fixed costs could spread over more output and, hence, enterprises are more likely to invest in R&D after a merger and acquisition deal has taken place. The efficiency of the innovation activity would also be increased through the elimination of the duplicated R&D inputs. Cost-consuming activities will be restructured or eliminated, coinciding with a shortening of the period. Finally, by combining the knowledge of two entities, mergers may lead to knowledge synergies. Seth (1990) points out that acquirer and target enterprises combine their complementary assets and knowledge to create synergies and hence generate a greater surplus in terms of production and technology.

On the other hand, there are concerns about the negative effect of M&A on enterprises' capacity to innovate. It is possible that the increase of financial leverage incurred by M&A affects the financing of R&D activity, leading to the elimination of R&D projects. Moreover, merger and acquisition might disrupt the established routines of the merging firms, thus reducing productivity (Pritchett 1985; Haspeslagh & Jemison 1991; Hitt *et al.* 1991), while the integration problem or cultural dissonance might hamper the probability of successful innovation.

To address this debate, scholars have proposed three types of factors that contribute to post-acquisition innovation activity. The first type of factor is related to the acquirer's resources and includes the

acquirer's finance capacity, policy support, etc. (see Desyllas & Hughes 2010; Yang et al. 2019 for instance). These resources allow acquirers to invest more in R&D activity after the deal has been secured. The second type of factor pertains to the capacity to integrate, which is also important in the realisation of knowledge synergies after the deal. It involves technological similarity, resource complementarity, and stakeholder orientation (Ahuja & Katila 2001; Cassiman et al. 2005; Cloodt et al. 2006; Cefis & Marsili 2019). The last type of factor is associated with the acquirer's orientation, which has great influence on the patterns of the innovation input and output (Cassiman *et al.* 2005). For example, firms with explorative orientation are more likely to invest more in R&D but gain less in the short term as they are required to explore new knowledge and to solve non-routine problems, which is costly and time consuming.

3.2.2 State ownership and post-acquisition innovation activities in China

State-owned (SOE) acquirers can outperform private-owned (POEs) acquirers in terms of innovation through both their superior resources, as provided by the government, and their capacity to integrate. In terms of resources, SOEs in China have preferential access to financial capital (Choi *et al.* 2011; Zhou *et al.* 2015), allowing them to invest more in complementary assets, including R&D investment. Meanwhile, government policies – such as industry license and market entry barriers – may discriminate in favour of SOE acquirers by imposing less stringent restrictions and allowing higher marginal profits, thus enhancing their ability in post-acquisition innovation and helping them outperform POEs after M&A (Zhou *et al.* 2015). Additionally, in the command economy of China, SOE acquirers may dominate the takeover competition against POE firms through government intervention (Wang *et al.* 2011).

With regards to the capacity to integrate, SOE acquirers are also likely to experience a smooth integration with the target firm, facilitating the following knowledge-base integration and hence the innovation performance. First, since SOE acquirers with the government intervention aim to ensure social stability and care about the interests of the state (Dong *et al.* 2014), they can secure support from the stakeholder during the process of the M&A and hence outperform others in terms of innovation. Second, SOE acquirers engage in business networking that grants them preferential access to production inputs and a smoothing or even a bypass of regulatory processes (Sun 2002), allowing them to compete for the right target and hence reduce the risk of post-acquisition integration.

Therefore, I would expect state ownership to have a positive impact on post-acquisition innovation activities. More specifically, state-owned enterprises in China are expected to undergo a significant increase in both R&D investment and in the number of patent publications following M&A transactions.

H1: State ownership has a positive impact on post-acquisition innovation activities.

3.2.3 Responsible innovation orientation, state ownership, and post-acquisition innovation activities

The notion of responsible innovation was first introduced by the European Union's Framework Programmes in 2010. In China, the 'Circular of the State Council on Issuing the National Scientific and Technological Innovation Planning for the 13th Five Years' emphasised the importance of sustainable development and responsible innovation. According to Owen *et al.* (2013), the orientation of responsible innovation is the 'right impact' on society. It is driven by grand challenges like global warming and sustainable development as well as by the interests of multiple stakeholders (Owen *et al.* 2012; Von Schomberg 2013), as opposed to being motivated solely by short-term profit maximisation. Meanwhile, because such grand challenges are highly complex and difficult to pin down (Rittel & Webber 1973), enterprises with a responsible innovation orientation must engage in explorative innovation by learning new approaches, solving non-routine problems (Jansen *et al.* 2006), developing the enhanced absorptive capacity to handle such problems (Seebode *et al.* 2012), and taking multiple stakeholder interests into account, rather than solely exploiting existing knowledge (Jansen *et al.* 2006).

Enterprises that are oriented towards responsible innovation are likely to have a higher level of R&D expenditure during the R&D process than their counterparts because exploring new knowledge to solve non-routine problems is difficult and risky (Uotila *et al.* 2009) and may lead to greater experimentation costs without producing many benefits in the short term (March 1991). Patents that are obtained at the later stage of the innovation process are typically the outputs from the preceding R&D activities (Scherer 1965; Bound *et al.* 1982).

As achieving responsible oriented innovation requires to explore new knowledge to solve non-routine problems and using this kind of exploratory path is often time consuming and resource intensive (Gama *et al.* 2022), it is irrational to expect an increase in terms of the number of ready-to-be patents for responsible-innovation-oriented enterprises shortly following M&A transactions.

In short, I expect that responsible-innovation-oriented SOE (RIOSOE) acquirers will spend more on R&D activity while obtaining less patents than do other SOE acquirers during a reasonable time window subsequent to mergers and acquisitions.

H2a: Responsible-innovation-oriented SOE acquirers invest more in R&D activities than other SOE acquirers shortly after M&A.

H2b: Responsible-innovation-oriented SOE acquirers produce fewer patents than other SOE acquirers shortly after M&A.

3.3 Methodology

3.3.1 Identification of responsible-innovation-oriented enterprises

In this paper, responsible innovation-oriented enterprises are identified based on its industry classification. Industry classification is suitable to be used as identification criterion because firms' innovation orientation could be reflected by industry classification. First, firms classified within a same industry shares similarity in the characteristics of their final product and main operating activities (see CSRC industry classification standard, 2012). Firm's final product is an outcome of its innovation activity so that its characteristics represents the innovation process, including innovation orientation. In addition, the responsible innovation also emphasizes the outcome of innovation. The definition of responsible innovation shows that innovation should have positive impacts and contribute towards social challenges (Owen *et al.* 2013; Von Schomberg 2013). Therefore, I use industry classification, which define the characteristic of firm's innovation outcome –product, to identify responsible innovation-oriented firms.

Specifically, I apply industry classification as specified by the China Securities Regulatory Commission (CSRC) and identify firms with responsible innovation orientation as those operating in industries whose characteristics are in line with those of responsible innovation according to Von Schomberg (2013).

Industries in such a category include socially responsible industries, green and sustainable industries, healthcare, and high-tech industries. Innovation in these industries is more concerned with social welfare. For example, Chinese High-speed Rail (HSR) projects carried out by firms have significantly reduced the travel time of passengers (Gutiérrez 2001), allowing passengers to allocate the saved time to other activities, to travel more frequently, and to travel over longer distances (Spiekermann & Wegener 1994). As another example, 'Alibaba Cloud', a kind of cloud computing storage, provides a more flexible system and service to deal with societal challenges associated with digitalisation.

Finally, I identify responsible-innovation-oriented enterprises as those belonging to the following industries: socially responsible industries (i.e. M73 Research and Experimental Development, M74 Professional Technical Service, and C37 Railway, marine, aerospace and other transportation equipment manufacturing); green or sustainable industries (i.e. N76 Water Conservancy Management, N77 Ecological Protection and Environmental Management, N78 Public Facilities Management, and

C42 Comprehensive Use of Waste Resources); healthcare industries (i.e. C27 Pharmaceutical Manufacturing); and high-tech industries (i.e. I63 Telecommunications, Radio, Television, and Satellite Transmission Services, I64 Internet and Related Services, and I65 Software and Information Technology Services).

3.3.2 Data

I use data from the Thomson One database and the China Stock Market & Accounting Research (CSMAR) database. The Thomson One database contains data related to merger and acquisition announcements as well as deal-specific information, while the CSMAR database contains accounting data, R&D data, and the patent information of all listed enterprises on the Shanghai and Shenzhen Stock Exchange in China.

To form the sample of M&A, I begin with all M&A deals announced and completed during the period from January 1st, 2009, to December 31st, 2015, in the Chinese market as shown in the Thomson One database. This filter yields 13,369 deals. I then retrieve all deals where the acquirer is listed aas an enterprise in the Shanghai or Shenzhen Stock Exchange and where the targets are domestic enterprises. I also require that the acquirers are covered by the CSMAR Database. These filters yield 1,128 deals where both the acquirers' accounting and innovation information is available and retrievable from CSMAR.[15]

To form the innovation activity dataset, I retrieve patent and R&D spending data three years before and after the deal from the CSMAR database during the period 2006 to 2018 in order to compare the innovation activity of acquirers in relation to M&A deals.

3.3.3 Empirical model

I primarily use OLS regression with cross-sectional data as of the fiscal year-end before the bid announcement to test my hypotheses:

[15] CSMAR contains comprehensive and detailed information on patents applied by Chinese listed enterprises, as well as their R&D expenditures each year, which are essential for us to track the innovation activity of acquirers.

$$
\begin{aligned}
&Innovation\ indicators_{it} \\
&= \alpha + \beta_1 SOE\ Acquirer\ Dummy_{it-1}(RIOSOE\ Acquirer\ Dummy_{it-1}) \\
&(NRIOSOE\ Acquirer\ Dummy_{it-1}) \\
&+\beta_2 Acquirer\ firm\ characteristics_{it-1} \\
&+\beta_3\ Target\ public\ status_{pt-1} \\
&+\beta_4 Deal\ characteristics_{qt-1} \\
&+\sum \gamma_t\ Year\ Dummy_t \\
&+\sum \delta_j\ Industry\ Dummy_j \quad (1)
\end{aligned}
$$

Dependent variables:

Innovation indicators I employ two variables to capture the post-acquisition innovation activity of the acquirer *i* in year *t* as $Innovation\ indicators_{it}$. The first variable is the growth rate in patent, where patent refers to the 'invention' type of patents as defined by CSMAR, while the second variable is the growth rate in R&D spending. Both measures are based on the application year because this year is closer to the time of the actual innovation than the grant year (Griliches *et al.* 1986). Meanwhile, the growth rates in both the patent and R&D spending of acquirers are measured across the three different event windows surrounding their respective acquisition deals: over a 6-year period between three years before the bid announcement (i.e. ayr-3) and three years after the bid announcement (i.e. ayr+3); over a 4-year period between two years before the bid announcement (i.e. ayr-2) and two years after the bid announcement (i.e. ayr+2); and over a 2-year period between one year before the bid announcement (i.e. ayr-1) and one year after the bid announcement (i.e. ayr +1). The growth rates are constructed as follows:

$$
\begin{aligned}
&Growth\ rate\ in\ R\&D\ spending\ (patent)_{i,t} \\
&= \frac{\sum_1^n R\&D\ spending\ (patent)_{i,t+n} - \sum_1^n R\&D\ spending\ (patent)_{i,t-n}}{\sum_1^n R\&D\ spending\ (patent)_{i,t-n}} \quad (2)
\end{aligned}
$$

where t is the year of the bid announcement and n equals 1, 2, or 3. $R\&D\ spending\ (patent)_{i,t+n}$ is R&D spending (patent counts) of the acquirer i in year $t+n$ and $R\&D\ spending\ (patent)_{i,t-n}$ is R&D spending (patent counts) of the acquirer i in year $t-n$.

Independent variables:

$SOE\ Acquirer\ Dummy_{it}$ My first independent variable $SOE\ Acquirer\ Dummy_{it}$ equals one if the acquirer *i* is a state-owned enterprise (SOEs) in year t, and zero otherwise. Following the method adopted by Berkman *et al.* (2010), I identify as SOEs those enterprises whose largest shareholder is a government agency or government institution.

$RIOSOE\ Acquirer\ Dummy_{it}$ *and* $NRIOSOE\ Acquirer\ Dummy_{it}$ I first define industries with responsible innovation orientation as those whose characteristics listed by the China Securities

Regulatory Commission (CSRC) are in line with the characteristics of responsible innovation (i.e. ethically acceptable, sustainable, socially desirable, and safe for the environment and human health) as listed by Von Schomberg (2013) in his paper constructing the framework of responsible innovation. Finally, I also identify industries that are socially responsible (i.e. M73 Research and Experimental Development, M74 Professional Technical Service, and C37 Railway, Marine, Aerospace and Other Transportation Equipment Manufacturing); that are green or sustainable (i.e. N76 Water Conservancy Management, N77 Ecological Protection and Environmental Management, N78 Public Facilities Management , and C42 Comprehensive Use of Waste Resources); that are related to healthcare (i.e. C27 Pharmaceutical Manufacturing); and that are related to high tech (i.e. I63 Telecommunications, Radio, Television, and Satellite Transmission Services, I64 Internet and Related Services, and I65 Software and Information Technology Services) as responsible-innovation-oriented industries. I then construct $RIOSOE\ Acquirer\ Dummy_{it}$, which equals one if the acquirer is a state-owned enterprise (SOEs) and is operating within responsible-innovation-oriented industries, and zero otherwise. I also construct $NRIOSOE\ Acquirer\ Dummy_{it}$, which equals one if the acquirer is a state-owned enterprise (SOEs) but in other industries in year t, and zero otherwise.

Control variables: $\sum Year\ Dummy_t$ and $\sum Industry\ Dummy_j$ are year and industry fixed effects, respectively, for each acquirer. Other control variables – $Acquirer\ firm\ characteristics_{it-1}$, $Target\ public\ status_{pt-1}$, $Deal\ characteristics_{qt-1}$ – are defined in Appendix A.

3.4 Does state ownership drive post-acquisition innovation?

3.4.1 Main result

Univariate analysis

Table 3.1 presents descriptive statistics for the full sample of 1,128 deals. The sample was limited to the deals involving state-owned acquirers and the subsamples of state-owned acquirers divided into state-owned acquirers in industries with responsible innovation orientation (RIOSOE acquirers) and those in other industries (NRIOSOE acquirers). In Table 3.1A, I show that, on average, SOE acquirers have a significantly higher debt to total asset and cash flow to equity than POE acquirers, that they prefer high-value deals, and that these deals perform well both in the short term and in the long term. These results are consistent with my proposal that SOEs are not expected to experience financial shortages (Cull & Xu 2003) but are inconsistent with the finding that SOE acquirers are able to achieve better performance than do POE acquirers after the transaction has taken place (Zhou *et al.* 2015). Moreover, the result of univariate analysis in panel C of Table 3.1A aligns with Hypothesis 1 as it shows a significant difference between SOE and POE acquirers in R&D expenditure and in the number of patents after the M&A event has occurred.

Table 3.1 Descriptive statistics and univariate analysis

This table reports the summary statistics and univariate analysis. In table 3.1A, I split the full sample into state-owned (SOE) acquirers and non-SOE acquirers and report the descriptive statistics for the full sample and the differences between the subsample of SOE acquirers and non-SOE acquirers. In Table 3.1B, I limit the sample to deals with state-owned acquirers. The subsample of state-owned acquirers is then further divided based on whether the state-owned acquirers are oriented towards responsible innovation. Panel A reports the firm characteristics of acquirers. Panel B shows the acquisition-related information. Panel C lists the statistics of innovation activities. All denoted variables are specifically defined in Appendix A. A two-tailed t-test is employed to explore the difference of variable in means between connected and non-connected deals. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3.1 A full sample

Variables	Full sample (I)		State-owned (SOE) acquirers (II)		Non-State-owned acquirers (III)		Difference (II) -(III)	
	Mean	SD	Mean	SD	Mean	SD		
Panel A: Acquirer characteristics								
MV (logarithm)	19.837	0.884	19.842	0.906	19.814	0.763	0.028	
Tobin's Q	2.006	1.962	1.972	1.972	2.174	1.911	0.202	
Return on equity (ROE)	0.048	0.067	0.048	0.071	0.046	0.041	0.002	
Debt to total asset	0.015	0.044	0.017	0.047	0.006	0.024	0.010	***
Cash flow to equity	0.565	0.660	0.596	0.706	0.413	0.319	0.183	***
Panel B: Deal characteristics								
Transaction value ($millions)	86.38	338.2	95.26	368.534	41.829	67.747	53.431	***
Diversification (number)	659		529		130			

Pure cash deal (number)	295		252		43			
Public deal (number)	42		42		0			
3-day acquirer cumulative abnormal return (ACAR (-1, +1))	0.012	0.061	0.010	0.061	0.018	0.058	-0.007	**
5-day acquirer cumulative abnormal return (ACAR (-2, +2))	0.015	0.073	0.012	0.074	0.027	0.071	-0.015	***
11-day acquirer cumulative abnormal return (ACAR (-5, +5))	0.021	0.097	0.018	0.096	0.037	0.100	-0.019	***
12-month acquirer buy-and-hold abnormal return (BHAR_12m)	0.094	0.54	0.080	0.498	0.171	0.717	-0.091	***
24-month acquirer buy-and-hold abnormal return (BHAR_24m)	0.125	0.71	0.110	0.709	0.205	0.712	-0.095	***
36-month acquirer buy-and-hold abnormal return (BHAR_36m)	0.13	0.875	0.109	0.883	0.238	0.825	-0.129	***
12-month acquirer industry-adjusted return on equity (IAROE_12months)	0.011	0.074	0.011	0.077	0.011	0.057	0.000	
24-month acquirer industry-adjusted return on equity (IAROE_24months)	0.007	0.069	0.008	0.071	0.006	0.058	0.002	
36-month acquirer industry-adjusted return on equity (IAROE_36months)	-0.001	0.099	-0.001	0.104	-0.002	0.068	0.000	
Panel C: Innovation activities								
Growth rate in R&D over 3-year period (ΔR&D (-1, +1))	0.565	1.431	0.627	1.599	0.364	0.591	0.263	***

Growth rate in R&D over 5-year period (ΔR&D (-2, +2))	0.985	1.611	1.045	1.718	0.807	1.221	0.238	***
Growth rate in R&D over 7-year period (ΔR&D (-3, +3))	1.444	2.025	1.508	2.146	1.269	1.639	0.239	**
Growth rate in Patent over 3-year period (ΔPatent (-1, +1))	0.273	2.965	0.273	3.032	0.271	2.646	0.003	
Growth rate in Patent over 5-year period (ΔPatent (-2, +2))	0.363	2.480	0.445	2.601	0.010	1.837	0.435	***
Growth rate in Patent over 7-year period (ΔPatent (-3, +3))	0.368	2.016	0.466	2.082	-0.14	1.532	0.607	***
Number of observations	1128		939		189			

Table 3.1B Subsample of state-owned acquirers

Variable	RIOSOE acquirers (III)		NRIOSOE acquirers (IV)		Difference (IV) -(III)	
	Mean	SD	Mean	SD		
Panel A: Acquirer characteristics						
MV (logarithm)	19.848	1.127	19.839	0.802	0.009	
Tobin's Q	2.475	2.571	1.771	1.633	0.704	***
Return on equity (ROE)	0.056	0.064	0.045	0.073	0.011	
Debt to total asset	0.017	0.048	0.017	0.046	0.000	
Cash flow to equity	0.394	0.347	0.677	0.792	-0.283	***

Panel B: Deal characteristics						
Transaction value ($millions)	79.711	198.92	101.801	419.875	-22.09	
Diversification (number)	108		421			
Pure cash deal (number)	80		172			
Public deal (number)	38		4			
3-day acquirer cumulative abnormal return (ACAR (-1, +1))	0.007	0.066	0.011	0.06	-0.004	*
5-day acquirer cumulative abnormal return (ACAR (-2, +2))	0.008	0.081	0.013	0.072	-0.005	**
11-day acquirer cumulative abnormal return (ACAR (-5, +5))	0.016	0.103	0.019	0.095	-0.003	*
12-month acquirer buy-and-hold abnormal return (BHAR_12m)	0.139	0.549	0.064	0.482	0.075	**
24-month acquirer buy-and-hold abnormal return (BHAR_24m)	0.208	0.679	0.084	0.715	0.124	***
36-month acquirer buy-and-hold abnormal return (BHAR_36m)	0.238	0.87	0.074	0.883	0.164	***
12-month acquirer industry-adjusted return on equity (IAROE_12months)	0.019	0.062	0.009	0.081	0.010	***
24-month acquirer industry-adjusted return on equity (IAROE_24months)	0.012	0.078	0.006	0.068	0.006	***
36-month acquirer industry-adjusted return on equity (IAROE_36months)	0.011	0.06	-0.005	0.114	0.016	***
Panel C: Innovation activities						
Growth rate in R&D over 3-year period (ΔR&D (-1, +1))	0.781	1.676	0.561	1.561	0.220	***
Growth rate in R&D over 5-year period (ΔR&D (-2, +2))	1.319	1.762	0.923	1.685	0.396	***
Growth rate in R&D over 7-year period (ΔR&D (-3, +3))	1.881	1.818	1.331	2.265	0.550	***
Growth rate in Patent over 3-year period (ΔPatent (-1, +1))	-0.090	2.188	0.392	3.254	-0.482	**
Growth rate in Patent over 5-year period (ΔPatent (-2, +2))	0.114	2.031	0.550	2.750	-0.436	**

Growth rate in patent over 7-year period (ΔPatent (-3, +3))	0.177	1.835	0.540	2.135	-0.363	**
Number of observations	269		670			

In Table 3.1B, I show that RIOSOE acquirers have significantly higher Tobin's Q but lower cash flow to equity than NRIOSOE acquirers. Since Tobin's Q measures the management performance of an enterprise (Lang & Stulz 1994), these results suggest that state-owned acquirers in industries with responsible innovation orientation perform better financially than those in other industries but are able to issue less free cash to their equity holders compared to those in other industries.

Then, in Panel B of Table 3.1B, I further show that RIOSOE acquirers have significant lower announcement return than do other acquirers. Nevertheless, in the long term, RIOSOE acquirers realise significantly higher *buy-and-hold returns* and higher *industry-adjusted ROE* than do NRISOE acquirers. The univariate statistics suggest the importance of distinguishing between the short-term and long-term acquisition-related performance of RIOSOE acquirers and NRISOE acquirers. In the last panel of Table 3.1B, I show that RIOSOE acquirers exhibit a significantly higher increase in R&D spending but a lower increase in innovation output than NRISOE acquirers. The univariate statistics also suggest the importance of distinguishing between innovation output (i.e. patent counts) and R&D spending when investigating the role of state ownership in post-acquisition innovation activities (Bena & Li 2014).

3.4.2 State ownership and post-M&A innovation

Table 3.2, Panel A, reports the coefficient estimates from the OLS regression (1), using the growth rate in R&D spending as the dependent variable. Using the growth rate in R&D spending with various time windows around the deal announcement date (i.e., $\Delta R\&D(-1,+1)$, $\Delta R\&D(-2,+2)$, $\Delta R\&D(-3,+3)$), I show that M&A deals announced by state-owned acquirers (SOE acquirers) would incur 25 percentage points more spending in R&D activity. In all cases, the coefficients on the dummy variable of SOE acquirers are positive and significant. I also find that acquirers with higher Tobin's Q would have a lower growth rate in R&D spending and that M&A deals aiming to acquire public targets or to be paid with cash would experience a lower growth rate in R&D spending.

Table 3.2 State ownership and the post-acquisition innovation activities

This table reports the multivariate analysis for R&D investment (which evaluates the input of innovation activities) and for the growth rate of the number of patents (which evaluates the output of innovation activities). In all models, the growth rate in R&D investment is regressed against dummy variables related to acquirers. In Models 1 and 2 of Panel A, the dependent variables are the growth rate of R&D investment over a 3-year period around the takeover announcement (ΔR&D (-1, +1)). The dependent variables in Models 3 and 4 of Panel A are the growth rate of R&D investment over a 5-year period around the takeover announcement (ΔR&D (-2, +2)). In Models 5 and 6 of Panel A, the dependent variables are the growth rate of R&D investment over a 7-year period around the takeover announcement (ΔR&D (-3, +3)). In Models 1 and 2 of Panel B, the dependent variables are the growth rate of patent counts over a 3-year period around the takeover announcement (ΔPatent (-1, +1)). The dependent variables in Models 3 and 4 of Panel B are the growth rate of patent counts over a 5-year period around the takeover announcement (ΔPatent (-2, +2)). In Models 5 and 6 of Panel B, the dependent variables are the growth rate of patent counts over a 7-year period around the takeover announcement (ΔPatent (-3, +3)). The independent variable is SOE acquirers, which equals one if the acquirers are state-owned enterprises, and zero otherwise. In Models 2, 4, and 6 of all panels, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Growth rate in R&D for SOE acquirers

Growth rate in R&D	ΔR&D (-1, +1)		ΔR&D (-2, +2)		ΔR&D (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)
SOE acquirers	0.263***	0.289***	0.238***	0.263***	0.239**	0.381**
	(5.52)	(4.35)	(3.27)	(2.73)	(1.99)	(2.23)
Acquirer Tobin's Q		-0.027***		-0.020**		0.018
		(-3.06)		(-2.00)		(0.70)
Acquirer ROE		-0.006		0.294***		0.390***
		(-0.02)		(2.67)		(2.69)

Acquirer leverage		-0.070		0.005		1.001
		(-0.07)		(0.00)		(0.52)
Acquirer cash flow to asset		-0.027		-0.221		-0.762**
		(-0.15)		(-0.95)		(-2.34)
Target public status		-0.515***		-0.412**		-0.713
		(-3.11)		(-2.22)		(-1.14)
Diversification deal		0.006		-0.073		0.138
		(0.07)		(-0.73)		(0.82)
Cash deal		-0.366***		-0.479***		-0.702***
		(-4.28)		(-4.47)		(-3.82)
Constant	0.364***	0.164	0.807***	1.668***	1.269***	2.727***
	(13.81)	(0.33)	(14.29)	(3.83)	(13.45)	(3.80)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.006	0.061	0.004	0.056	0.002	0.054
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Growth rate in patent for SOE acquirers

Growth rate in patent	ΔPatent (-1, +1)		ΔPatent (-2, +2)		ΔPatent (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)
SOE acquirers	0.003	-0.137	0.435***	0.308**	0.607***	0.423***

	(0.01)	(-0.60)	(3.75)	(2.09)	(4.95)	(2.84)
Acquirer Tobin's Q		-0.021		-0.026*		-0.052
		(-1.22)		(-1.73)		(-1.56)
Acquirer return on equity		2.462*		-0.050		-0.115
		(1.88)		(-0.24)		(-0.25)
Acquirer leverage		3.151*		3.376**		0.981
		(1.75)		(2.29)		(1.13)
Acquirer cash flow to asset		1.027***		1.098***		0.654***
		(2.68)		(3.30)		(3.04)
Target public status		2.582		-0.549*		-0.283
		(1.28)		(-1.68)		(-0.89)
Diversification deal		-0.538**		-0.287*		-0.246*
		(-2.53)		(-1.88)		(-1.74)
Cash deal		-0.140		0.106		-0.138
		(-0.70)		(0.74)		(-1.03)
Constant	0.271*	-0.666**	0.010	-1.172***	-0.140	-0.923***
	(1.76)	(-2.13)	(0.10)	(-4.25)	(-1.33)	(-3.59)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.001	0.043	0.004	0.042	0.012	0.063
Number of observations	1128	1128	1128	1128	1128	1128

In Panel B, I report the coefficient estimates from OLS regression (1) on the growth rate in patents count. I show that state ownership is positively related to the growth rate in patents over a 2-year period around the takeover announcement (ΔPatent (-1, +1)), over a 4-year period around the takeover announcement (ΔPatent (-2, +2)), and over a 6-year period around the takeover announcement (ΔPatent (-3, +3)). On average, SOE acquirers generate 50 percentage points more patents after M&A has taken place than do non-SOE acquirers. The coefficient estimate of SOE acquirers dummy is insignificant for the time window (-1, 1) years, but it becomes significant when I measure the growth rate in patents for longer time windows (i.e. ΔPatent (-2, +2) and ΔPatent (-3, +3)). I also find that the acquirer's return on equity is positively related to ΔPatent (-1, +1) at the 10% significance level; that the acquirer's Tobin's Q is positively related to ΔPatent (-2, +2) at the 10% significance level; that the acquirer's cash flow to asset is positively and significantly related to the growth rate in patents; and that those diversified deals will incur less growth in patents after mergers and acquisitions have taken place.

Overall, my results provide strong support for Hypothesis 1, which posits that state ownership has a positive impact on post-acquisition innovation activities in China. I show that M&A deals announced by state-owned acquirers would incur more R&D spending and lead to higher innovation output in terms of newly granted patents.

3.4.3 Responsible innovation orientation and SOAs post-M&A innovation

Table 3.3, Panel A presents coefficient estimates from the OLS regression (1) on the growth rate in R&D spending, using the RIOSOE acquirer dummy as the independent variable. The growth rates in R&D spending of RIOSOE acquirers over all event windows considered (i.e. $\Delta R\&D(-1,+1)$, $\Delta R\&D(-2,+2)$, $\Delta R\&D(-3,+3)$) are significantly higher than those of other acquirers. Compared to other acquirers, RIOSOEs raise their R&D spending by 50 percentage points after M&A.

Table 3.3 State ownership and post-acquisition innovation in responsible-innovation industries

This table reports the multivariate analysis for R&D investment (which evaluates the input of innovation activities) and for growth rate in the number of patents (which evaluates the output of innovation activities). In all models, the growth rate in R&D investment is regressed against dummy variables related to acquirers. In Models 1 and 2 of Panels A and C, the dependent variables are the growth rate of R&D investment over a 3-year period around the takeover announcement (ΔR&D (-1, +1)). The dependent variables in Models 3 and 4 of Panels A and C are the growth rate of R&D investment over a 5-year period around the takeover announcement (ΔR&D (-2, +2)). In Models 5 and 6 of Panels A and C, the dependent variables are the growth rate of R&D investment over a 7-year period around the takeover announcement (ΔR&D (-3, +3)). In Models 1 and 2 of Panels B and D, the dependent variables are the growth rate of patent counts over a 3-year period around the takeover announcement (ΔPatent (-1, +1)). The dependent variables in Models 3 and 4 of Panels B and D are the growth rate of patent counts over a 5-year period around the takeover announcement (ΔPatent (-2, +2)). In Models 5 and 6 of Panels B and D, the dependent variables are the growth rate of patent counts over a 7-year period around the takeover announcement (ΔPatent (-3, +3)). In Panels A and B, the independent variable is RIOSOE acquirers, which equals one if acquirers are stated-owned enterprises with responsible innovation orientation, and zero otherwise. In Panel C, the independent variable is NRIOSOE acquirers, which equals one if the acquirer is a state-owned enterprise (SOEs) excluding those with responsible innovation orientation, and zero otherwise. In Models 2, 4, and 6 of all panels, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Growth rate in R&D spending for RIOSOE acquirers

Growth rate in R&D	ΔR&D (-1, +1)		ΔR&D (-2, +2)		ΔR&D (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)
RIOSOE acquirers	0.280***	0.441***	0.434***	0.500***	0.572***	0.520***
	(3.38)	(3.47)	(4.60)	(3.56)	(4.33)	(2.60)
Acquirer Tobin's Q		-0.032***		-0.025**		0.013
		(-3.37)		(-2.32)		(0.51)

Acquirer ROE		-0.012		0.297***		0.370**
		(-0.04)		(2.72)		(2.53)
Acquirer leverage		0.111		0.100		1.041
		(0.12)		(0.10)		(0.54)
Acquirer cash flow to asset		0.051		-0.131		-0.596*
		(0.27)		(-0.56)		(-1.83)
Target public status		-0.490***		-0.432**		-0.726
		(-2.82)		(-2.17)		(-1.19)
Diversification deal		0.040		-0.032		0.170
		(0.48)		(-0.33)		(1.02)
Cash deal		-0.358***		-0.463***		-0.689***
		(-4.11)		(-4.30)		(-3.72)
Constant	0.500***	1.339**	0.885***	2.171***	1.309***	2.822***
	(15.07)	(2.00)	(21.62)	(5.58)	(18.57)	(4.16)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.006	0.068	0.012	0.065	0.014	0.057
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Growth rate in patent for RIOSOE acquirers

Growth rate in patent	ΔPatent (-1, +1)		ΔPatent (-2, +2)		ΔPatent (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)

RIOSOE acquirers	-0.455***	-0.607	-0.310**	0.000	-0.231*	0.017
	(-3.06)	(-1.43)	(-2.53)	(0.00)	(-1.68)	(0.09)
Acquirer Tobin's Q		-0.056		-0.110***		-0.102***
		(-1.58)		(-2.77)		(-2.87)
Acquirer ROE		-0.739		0.107		-0.348
		(-0.24)		(0.07)		(-0.29)
Acquirer leverage		-0.022**		-0.011**		-0.015***
		(-2.19)		(-2.05)		(-2.74)
Acquirer cash flow to asset		1.192**		1.622***		0.964***
		(2.31)		(3.52)		(3.37)
Target public status		2.780		-0.677*		-0.237
		(1.20)		(-1.70)		(-0.64)
Diversification deal		-0.729**		-0.255		-0.262*
		(-2.56)		(-1.36)		(-1.67)
Cash deal		-0.374		-0.119		-0.136
		(-1.46)		(-0.67)		(-0.89)
Constant	0.364***	-0.539	0.424***	-0.695**	0.408***	-0.351
	(4.20)	(-1.53)	(6.51)	(-2.07)	(6.55)	(-1.23)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.003	0.042	0.002	0.052	0.001	0.056
Number of observations	1128	1128	1128	1128	1128	1128

Panel C: Growth rate in R&D for NRIOSOE acquirers

Growth rate in R&D	ΔR&D (-1, +1)		ΔR&D (-2, +2)		ΔR&D (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)
NRIOSOE acquirers	-0.008	-0.091	-0.129*	-0.146	-0.224*	-0.058
	(-0.14)	(-1.03)	(-1.74)	(-1.35)	(-1.86)	(-0.31)
Acquirer Tobin's Q		-0.029***		-0.022**		0.014
		(-3.26)		(-2.21)		(0.57)
Acquirer ROE		-0.018		0.284**		0.383**
		(-0.07)		(2.53)		(2.57)
Acquirer leverage		0.213		0.389		1.459
		(0.22)		(0.41)		(0.75)
Acquirer cash flow to asset		0.011		-0.171		-0.668**
		(0.06)		(-0.73)		(-2.07)
Target public status		-0.442***		-0.332*		-0.543
		(-2.69)		(-1.78)		(-0.87)
Diversification deal		0.013		-0.067		0.130
		(0.15)		(-0.66)		(0.77)
Cash deal		-0.388***		-0.498***		-0.715***
		(-4.51)		(-4.65)		(-3.88)
Constant	0.569***	1.489**	1.052***	2.342***	1.556***	3.044***
	(14.14)	(2.09)	(20.66)	(5.81)	(21.14)	(4.31)

Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.000	0.056	0.001	0.053	0.002	0.049
Number of observations	1128	1128	1128	1128	1128	1128
Panel D: Growth rate in patent for NRIOSOE acquirers						
Growth rate in patent	ΔPatent (-1, +1)		ΔPatent (-2, +2)		ΔPatent (-3, +3)	
	(1)	(2)	(3)	(4)	(5)	(6)
NRIOSOE acquirers	0.312**	0.385*	0.487***	0.398***	0.518***	0.414***
	(2.20)	(1.87)	(4.58)	(2.86)	(4.75)	(3.02)
Acquirer Tobin's Q		-0.016		-0.022		-0.054
		(-0.96)		(-1.43)		(-1.53)
Acquirer ROE		2.542*		-0.042		-0.044
		(1.92)		(-0.20)		(-0.09)
Acquirer leverage		2.780		3.326**		1.033
		(1.58)		(2.27)		(1.18)
Acquirer cash flow to asset		0.926**		1.049***		0.616***
		(2.34)		(3.17)		(2.87)
Target public status		2.470		-0.559*		-0.279
		(1.23)		(-1.74)		(-0.90)
Diversification deal		-0.568***		-0.313**		-0.263*
		(-2.63)		(-2.03)		(-1.86)
Cash deal		-0.130		0.099		-0.148
		(-0.66)		(0.70)		(-1.12)

Constant	0.081	-1.046***	0.063	-1.198***	0.022	-0.873***
	(0.83)	(-4.19)	(0.89)	(-4.61)	(0.27)	(-3.62)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.002	0.046	0.009	0.045	0.014	0.056
Number of observations	1128	1128	1128	1128	1128	1128

In contrast to Panel A, Panel B shows that the coefficient estimates of RIOSOE acquirers are significantly and negatively related to the growth rate in patent counts over all the event windows I considered (i.e. ΔPatent (-1, +1), ΔPatent (-2, +2), ΔPatent (-3, +3) years) without control variables included in the regressions. When I add control variables, the coefficient estimates become insignificant in all three cases. These results add to the univariate analysis results as shown in Table 3.1B Panel C. For other control variables, results in these two regressions are consistent with those of regression on the growth rate in R&D for SOE acquirers.

In Table 3.3, Panels C and D report the coefficient estimates of other acquirers excluding RISOEs in relation to the growth rates in both R&D and patent counts, respectively. What I observe is largely a mirror image of those for RIOSOE acquirers.

Combining the results reported in Table 3.3, I show that RIOSOE acquirers will invest more in R&D projects but experience a lower increase in the success of patent applications. This finding is both important and novel in the literature, suggesting that responsible-innovation-oriented projects conducted by RIOSOE acquirers are likely to incur more R&D costs but to suffer low growth rate in generating patents at least in the first several years following mergers and acquisitions.
In summary, the results in Table 3.3 provide strong support for my second hypothesis, which posits that state-owned enterprises in industries with responsible innovation orientation invest more in R&D activities than other acquirers after M&A, and that state-owned enterprises in industries with responsible innovation orientation produce fewer patents than those in other industries after merger and acquisition.

3.4.4 Robustness check

This section describes a variety of robustness checks that interested readers can request. The first type of robustness check considers alternative measures of innovation activity. I conduct my OLS regression on sales-scaled R&D spending growth rate and operating-profit-scaled R&D spending growth rate. I also conduct my OLS regressions on the growth rate in patent counts, where patents include not only ‘invention’ but also ‘design’ and ‘utility’ types of patents. The results remain.

A second robustness check demonstrates that the pre- and post-acquisition change of innovation activities and performance for SOE acquirers both in responsible-innovation-oriented industries and in other industries are more significant than for POEs acquirers. I construct three dummy variables – POE acquirers, RIOPOEs acquirers, and NRIOPOEs – and use them as independent variables in the same regressions that I run for SOE acquirers. The results of regressions against POE acquirers are less

sensitive than those of regressions against SOE acquirers, indicating that the results for SOE acquirers are robust. Detailed results will be provided upon request.

4.3 Endogeneity check

In order to address the potential endogeneity bias, I conduct 2-stage-least square (2SLS) regression on the post-acquisition R&D expenditure, the change patent counts, and the post-acquisition performance with IV_company_name as an instrumental variable for SOEs. IV_company_name is a dummy variable indicating whether the full name of an acquirer starts with 'China, 'State', or 'Nation'. I observe a significantly positive relationship between SOE acquirer and innovation activities (e.g. R&D expenditure, Patent), a significantly negative relationship between SOE acquirer and CARs, and an insignificant relationship between SOE acquirer and long-term performance (e.g. BHARs, IAROEs). These findings are consistent with the results I presented in the previous section, which confirms that the issues associated with endogeneity bias are limited in my model. Detailed results are provided in Appendix B.

3.5 Do M&A deals create value for RIOSOE acquirers?

3.5.1 Market reaction to the M&A announcement of RIOSOE acquirers

Thus far, I have shown that state ownership has a positive effect on post-acquisition innovation and that RIOSOE acquirers scale up R&D investment and decelerate the progress of patent publications. I then discuss the possible market reaction to the acquisitions announced by RIOSOEs.

M&A deals announced by RIOSOEs act as signals that enterprises will spend more resources on R&D programmes that look after different stakeholders' interests and are likely to take a long time to produce the outcome (i.e. patent). According to the shareholder expense perspective (Friedman & Miles 2002; Pagano & Volpin 2005; Surroca & Tribó 2008; Cronqvist *et al.* 2009), managers engage in activities that help other stakeholders at the expense of shareholders, resulting in a wealth transfer from shareholder to stakeholder. The shareholder expense view predicts that RIOSOEs engage in M&A activity with the intention of improving the responsible innovation capability of the enterprise at the expense of shareholders and thereby decrease the shareholder wealth. In this case, benefits that other stakeholders gain from the responsible innovation come at the expense of shareholder interest, leading to a wealth transfer from shareholders to other stakeholders (Deng *et al.* 2013). Hence, it is likely that the market negatively reacts to the announcement of acquisitions initiated by responsible-innovation-oriented SOE acquirers.

In terms of the market reaction to the acquisition announcement, I follow the method adopted by Brown and Warner (1985) in order to construct the cumulated abnormal returns (CARs)[16] as a proxy for the acquirer's short-term market performance.

Table 3.4 reports the results of OLS regression (1) on CARs over various event windows (i.e. CAR (-1, +1), CAR (-2, +2), CAR (-5, +5) days). Columns (1) and (2) report the results of regression on CAR (-1, +1); columns (3) and (4) report the results of regression on CAR (-2, +2); and columns (5) and (6) report the results of regression on CAR (-5, +5).

[16] A detailed definition can be found in Appendix A.

Table 3.4

Table 3.4 Market reaction to the M&A announcement

This table displays the multivariate analysis for the takeover announcement return. In all models, the acquirer announcement return is regressed against dummy variables related to acquirers. In Models 1 and 2, the dependent variables are the cumulative abnormal return for acquirers over the period one day prior to one day after the announcement day (ACAR (-1, +1)). The dependent variables in Models 3 and 4 are the cumulative abnormal return for acquirers over the period one day prior to one day after the announcement day (ACAR (-2, +2)). In Models 5 and 6, the dependent variables are the cumulative abnormal return for acquirers over the period one day prior to one day after the announcement day (ACAR (-5, +5)). In Panel A, the independent variable is SOE acquirers, which equals one if the acquirers are state-owned enterprises, and zero otherwise. I then further divide the state-owned acquirers based on responsible innovation orientation classification. In Panel B, the independent variable is RIOSOE acquirers, which equals one if acquirers are stated-owned enterprises with responsible innovation orientation, and zero otherwise. In Panel C, the independent variable is NRIOSOE acquirers, which equals one if the acquirer is a state-owned enterprise (SOEs) excluding those with responsible innovation orientation, and zero otherwise. In Models 2, 4 and 6, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Announcement return of SOE acquirers						
Acquirer announcement return	CAR (-1, +1)		CAR (-2, +2)		CAR (-5, +5)	
	(1)	(2)	(3)	(4)	(5)	(6)
SOE acquirers	-0.007**	-0.010*	-0.015***	-0.018***	-0.019***	-0.014
	(-2.26)	(-1.95)	(-3.81)	(-2.71)	(-3.08)	(-1.51)
Acquirer Tobin's Q		-0.001*		-0.001		0.001
		(-1.71)		(-1.04)		(0.45)
Acquirer ROE		-0.033		0.020		0.028
		(-0.75)		(0.44)		(0.48)

Acquirer leverage		0.002		0.003		0.003
		(1.10)		(1.40)		(1.09)
Acquirer cash flow to asset		-0.000		0.000		0.000
		(-0.95)		(0.32)		(0.70)
Target public status		-0.006		0.010		0.018
		(-0.26)		(0.56)		(0.57)
Diversification deal		0.000		0.003		0.009
		(0.06)		(0.62)		(1.33)
Cash deal		-0.002		-0.004		-0.011
		(-0.57)		(-0.77)		(-1.43)
Constant	0.018***	0.020**	0.027***	0.029**	0.037***	0.021
	(6.19)	(2.41)	(7.57)	(2.50)	(6.62)	(1.41)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.002	0.013	0.006	0.012	0.005	0.008
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Announcement return of RIOSOE acquirers

Acquirer announcement return	CAR (-1, +1)		CAR (-2, +2)		CAR (-5, +5)	
	(1)	(2)	(3)	(4)	(5)	(6)
RIOSOE acquirers	-0.005	-0.008	-0.008*	-0.020**	-0.006	-0.025**
	(-1.47)	(-1.26)	(-1.77)	(-2.45)	(-1.00)	(-2.32)
Acquirer Tobin's Q		-0.000		-0.000		0.000

		(-0.72)		(-0.13)		(0.98)
Acquirer ROE		-0.034		0.017		0.023
		(-0.78)		(0.34)		(0.37)
Acquirer leverage		0.001		0.002		0.003
		(1.03)		(1.30)		(1.06)
Acquirer cash flow to asset		-0.000		0.000		0.000
		(-0.91)		(0.23)		(0.62)
Target public status		-0.006		0.009		0.013
		(-0.27)		(0.50)		(0.43)
Diversification deal		0.000		0.003		0.009
		(0.09)		(0.59)		(1.26)
Cash deal		-0.003		-0.003		-0.009
		(-0.60)		(-0.59)		(-1.15)
Constant	0.013***	0.012*	0.016***	0.014	0.022***	0.006
	(9.40)	(1.66)	(9.68)	(1.38)	(9.39)	(0.49)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.001	0.008	0.001	0.010	0.000	0.012
Number of observations	1128	1128	1128	1128	1128	1128
Panel C: Announcement return of NRIOSOE acquirers						
Acquirer announcement return	CAR (-1, +1)		CAR (-2, +2)		CAR (-5, +5)	
	(1)	(2)	(3)	(4)	(5)	(6)

NRIOSOE acquirers	-0.001	-0.002	-0.005	-0.001	-0.008	0.004
	(-0.51)	(-0.49)	(-1.40)	(-0.24)	(-1.64)	(0.50)
Acquirer Tobin's Q		-0.000		-0.000		0.000
		(-0.92)		(-0.38)		(0.75)
Acquirer ROE		-0.033		0.018		0.021
		(-0.75)		(0.35)		(0.33)
Acquirer leverage		0.001		0.002		0.003
		(1.05)		(1.30)		(1.02)
Acquirer cash flow to asset		-0.000		0.000		0.000
		(-0.84)		(0.30)		(0.61)
Target public status		-0.006		0.009		0.015
		(-0.25)		(0.50)		(0.49)
Diversification deal		0.001		0.003		0.009
		(0.17)		(0.69)		(1.33)
Cash deal		-0.003		-0.004		-0.010
		(-0.73)		(-0.77)		(-1.23)
Constant	0.013***	0.014	0.018***	0.015	0.027***	0.004
	(5.77)	(1.54)	(6.38)	(1.20)	(6.57)	(0.25)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.000	0.006	0.000	0.004	0.001	0.007
Number of observations	1128	1128	1128	1128	1128	1128

Panel A shows that estimates of the coefficient of SOE acquirer dummy are significantly negative in all cases. On average, SOE acquirers gain 1.9-percentage-point-lower returns than non-SOE acquirers. This finding is inconsistent with that of Zhou *et al.* (2015), who finds there to be an insignificant relationship between the state ownership of the acquirer and its CARs in China. I also find that none of the estimates of the coefficient of the control variable are significant in the regression.

I substitute the independent variable with the RIOSOE acquirer dummy in the baseline specifications presented in Panel A and present the result in Panel B. Columns (1), (2), and (5) show that the coefficient estimates of the RIOSOE acquirer dummy are insignificantly negative. Columns (3), (4), and (6) show that the coefficient estimates of RIOSOE acquirer dummy are significantly negative. I also find that none of the estimates of the coefficient of the control variable are significant in the regression.

I then substitute the independent variable with the NRIOSOE acquirer dummy in the baseline specifications presented in Panel A and present the result in Panel C. Results show that coefficients of the NRIOSOE acquirer dummy are insignificant in all cases and negative except for column (6). I also find that none of the estimates of the coefficient of the control variable are significant in the regression.

Combining the results in Table 3.4, I show that the market reaction to the announcement of M&A by RIOSOE acquirers is more negative than the market reaction to the announcement of M&A by other enterprises.

3.5.2 Long-term performance subsequent to M&A

In the long term, the transfer of wealth from shareholders to stakeholders may be reversed as stakeholder welfare is measured in intangibles (e.g., reputation), which are crucial to the competitiveness and survival of the enterprise (Zingales 2000; Jensen 2001b). Furthermore, responsible innovation that aims to radically develop new products and services for society provides a way to establish new markets. Such innovation is explorative in nature and would contribute to shareholder wealth in the long term (Levinthal & March 1993). Therefore, RIOSOE acquirers are expected to achieve long-term profitability and efficiency.

I follow Lyon et al. (1999) and construct buy-and-hold abnormal returns (BHARs)[17] as the proxy for the long-run market performance. Table 3.5 reports the results of OLS regression (1) on BHARs. Columns (1) and (2) report the results of regression on one-year BHAR; columns (3) and (4) report the

[17] A detailed definition can be found in Appendix A.

results of regression on two-year BHAR; and columns (5) and (6) report the results of regression on three-year BHAR.

Table 3.5 Long-term stock performance

This table shows the multivariate analysis for long-run stock performance, which is measured by buy-and-hold abnormal return. In all models, acquirers' long-run stock return is regressed against dummy variables related to acquirers. In Models 1 and 2, the dependent variables are the buy-and-hold abnormal return for acquirers over 12 months after the announcement day (BHAR_12months). The dependent variables in Models 3 and 4 are the buy-and-hold abnormal return for acquirers over 24 months after the announcement day (BHAR_24months). In Models 5 and 6, the dependent variables are the buy-and-hold abnormal return for acquirers over 36 months after the announcement day (BHAR_36months). In Panel A, the independent variable is SOE acquirers, which equals one if the acquirers are state-owned enterprises, and zero otherwise. I then further divide the state-owned acquirers based on responsible innovation orientation classification. In Panel B, the independent variable is RIOSOE acquirers, which equals one if acquirers are stated-owned enterprises with responsible innovation orientation, and zero otherwise. In Panel C, the independent variable is NRIOSOE acquirers, which equals one if the acquirer is a state-owned enterprise (SOEs) excluding those with responsible innovation orientation, and zero otherwise. In Models 2, 4 and 6, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Long-term stock performance for SOE acquirers

Post-M&A	Buy-and-hold	BHAR_12months		BHAR_24months		BHAR_36months	
abnormal return		(1)	(2)	(3)	(4)	(5)	(6)
SOE acquirers		-0.091**	-0.158***	-0.095**	-0.085*	-0.129***	-0.124**
		(-2.54)	(-2.82)	(-2.56)	(-1.78)	(-2.96)	(-2.26)
Acquirer Tobin's Q			0.001		0.004		0.002
			(0.29)		(0.79)		(0.39)
Acquirer ROE			-0.083*		-0.072		-0.062
			(-1.67)		(-1.33)		(-1.04)
Acquirer leverage			0.113		0.039		-0.244

		(0.81)		(0.24)		(-1.18)
Acquirer cash flow to asset		0.000		0.008		0.025***
		(0.10)		(1.53)		(4.35)
Target public status		-0.041		0.131		0.177
		(-0.36)		(0.57)		(0.66)
Diversification deal		0.043		0.056		0.035
		(1.49)		(1.58)		(0.84)
Cash deal		-0.107***		-0.053		-0.065
		(-3.50)		(-1.45)		(-1.44)
Constant	0.171***	0.068	0.205***	0.103	0.238***	1.545***
	(4.98)	(0.75)	(6.01)	(0.82)	(6.02)	(10.38)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.003	0.068	0.002	0.066	0.003	0.051
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Long-term stock performance for RIOSOE acquirers

Post M&A Buy-and-hold abnormal return	BHAR_12months		BHAR_24months		BHAR_36months	
	(1)	(2)	(3)	(4)	(5)	(6)
RIOSOE acquirers	0.054**	0.072*	0.100***	0.133***	0.132***	0.165***
	(2.01)	(1.94)	(2.83)	(2.94)	(3.02)	(3.00)
Acquirer Tobin's Q		0.004		0.004		0.001
		(0.81)		(0.75)		(0.18)

Acquirer ROE		-0.093**		-0.080		-0.062
		(-2.06)		(-1.44)		(-0.92)
Acquirer leverage		-0.114		-0.358*		-0.660***
		(-0.67)		(-1.71)		(-2.59)
Acquirer cash flow to asset		0.000		0.008		0.023
		(0.02)		(0.62)		(1.56)
Target public status		-0.087		0.110		0.175
		(-0.70)		(0.72)		(0.94)
Diversification deal		0.031		0.055		0.031
		(1.05)		(1.52)		(0.71)
Cash deal		-0.088***		-0.044		-0.056
		(-2.86)		(-1.16)		(-1.22)
Constant	0.085***	-0.103	0.107***	-0.114	0.106***	1.221
	(7.42)	(-0.18)	(7.15)	(-0.16)	(5.75)	(1.41)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.001	0.045	0.003	0.048	0.003	0.031
Number of observations	1128	1128	1128	1128	1128	1128

Panel C: Long-term stock performance for NRIOSOE acquirers

Post M&A Buy-and-hold abnormal return	BHAR_12months		BHAR_24months		BHAR_36months	
	(1)	(2)	(3)	(4)	(5)	(6)
NRIOSOE acquirers	-0.090***	-0.139***	-0.123***	-0.135***	-0.164***	-0.183***

	(-3.80)	(-3.84)	(-4.33)	(-3.56)	(-4.70)	(-4.14)
Acquirer Tobin's Q		0.000		0.002		0.000
		(0.05)		(0.46)		(0.05)
Acquirer ROE		-0.076		-0.066		-0.053
		(-1.61)		(-1.27)		(-0.95)
Acquirer leverage		0.062		0.009		-0.287
		(0.44)		(0.06)		(-1.44)
Acquirer Cash Flow to Asset		0.001		0.008		0.026***
		(0.20)		(1.60)		(4.37)
Target public status		-0.043		0.136		0.183
		(-0.37)		(0.59)		(0.69)
Diversification Deal		0.048*		0.062*		0.043
		(1.69)		(1.75)		(1.03)
Cash Deal		-0.101***		-0.050		-0.061
		(-3.39)		(-1.39)		(-1.36)
Constant	0.154***	-0.062	0.206***	0.047	0.238***	1.460***
	(7.38)	(-0.90)	(9.03)	(0.41)	(8.52)	(10.40)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.006	0.070	0.006	0.071	0.007	0.056
Number of observations	1128	1128	1128	1128	1128	1128

Panel A shows that estimates of the coefficient of the SOE acquirer dummy are significantly negative in all cases. I also find that acquirers' ROE is negatively related to the one-year BHAR of acquirers, that acquirers' cash flow to asset is significantly and positively related to the three-year BHAR, and that deals paid by cash may lead to lower BHAR for acquirers in the one-year holding period.
In Panel B, I use the RIOSOE acquirer dummy as the independent variable in the baseline specifications presented in Panel A. In contrast with the result in Panel A, coefficient estimates of the RIOSOE acquirer dummy are significantly positive in all cases. I also find that acquirers' ROE is negatively related to the one-year BHAR of acquirers, that acquirers' cash flow to asset is significantly and positively related to the two-year and three-year BHAR, and that deals paid by cash may lead to lower BHAR for acquirers with the one-year holding period.

In a similar vein, Panel C reports that the coefficient estimates of the NRIOSOE acquirer dummy are significantly negative in relation to BHAR. I also find that diversified deals or deals paid by cash are negatively related to the BHAR of acquirers.

It is reasonable to infer from the results in Table 3.5 that the negative post-acquisition return of SOE acquirers is primarily attributable to SOE acquirers in industries other than responsible-innovation-oriented industries.

Table 3.6 presents the results of OLS regression (1) on industry-adjusted ROEs. Columns (1) and (2) report the results of regression on one-year industry-adjusted ROE; columns (3) and (4) report the results of regression on two-year industry-adjusted ROE; and columns (5) and (6) report the results of regression on three-year industry-adjusted ROE.

Table 3.6 Long-term operational performance

This table shows the multivariate analysis for long-term operational performance, which is measured by acquirers' industry-adjusted return on equity (IAROE). IAROE is acquirers' return on equity, deducting median ROE in the industry as classified by the China Securities Regulatory Commission (CSRC). In all models, acquirers' IAROE is regressed against dummy variables related to acquirers. In Models 1 and 2, the dependent variables are the acquirers' industry-adjusted return on equity over 12 months after the announcement day (IAROE_12months). The dependent variables in Models 3 and 4 are the acquirers' industry-adjusted return on equity over 24 months after the announcement day (IAROE_24months). In Models 5 and 6, the dependent variables are the acquirers' industry-adjusted return on equity over 36 months after the announcement day (IAROE_36months). In Panel A, the independent variable is SOE acquirers, which equals one if the acquirers are state-owned enterprises, and zero otherwise. I then further divide the state-owned acquirers based on responsible innovation orientation classification. In Panel B, the independent variable is RIOSOE acquirers, which equals one if acquirers are stated-owned enterprises with responsible innovation orientation, and zero otherwise. In Panel C, the independent variable is NRIOSOE acquirers, which equals one if the acquirer is a state-owned enterprise (SOEs) excluding those with responsible innovation orientation, and zero otherwise. In Models 2, 4 and 6, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Long-term operation performance of SOE acquirers						
Post M&A Industry-adjusted return on equity	IAROE_12months		IAROE_24months		IAROE_36months	
	(1)	(2)	(3)	(4)	(5)	(6)
SOE Acquirers	0.000	-0.005	0.001	-0.001	0.000	-0.005
	(0.13)	(-1.05)	(0.44)	(-0.50)	(0.07)	(-0.73)
Acquirer Tobin's Q		0.001*		0.000		0.000
		(1.70)		(1.24)		(0.35)
Acquirer ROE		0.029***		0.012***		0.010

		(3.64)		(2.62)		(0.90)
Acquirer leverage		0.179***		0.004		0.013
		(7.54)		(0.28)		(0.39)
Acquirer cash flow to asset		0.002		0.000		0.002
		(1.53)		(0.09)		(1.10)
Target public status		0.068***		0.023**		0.040*
		(3.90)		(2.23)		(1.67)
Diversification deal		-0.007*		-0.006***		-0.011**
		(-1.92)		(-3.08)		(-2.24)
Cash deal		-0.009**		-0.003		0.001
		(-2.41)		(-1.50)		(0.21)
Constant	0.011***	0.066	0.008***	0.041	-0.002	0.191*
	(3.32)	(0.87)	(4.11)	(0.94)	(-0.37)	(1.86)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.000	0.063	0.000	0.041	0.000	0.023
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Long-term operation performance of RIOSOE acquirers

Post M&A Industry-adjusted return on equity	IAROE_12months		IAROE_24months		IAROE_36months	
	(1)	(2)	(3)	(4)	(5)	(6)
RIOSOE acquirers	0.010***	0.008*	0.007***	0.004*	0.015***	0.015***

	(3.16)	(1.78)	(3.39)	(1.70)	(3.42)	(2.66)
Acquirer Tobin's Q		0.001*		0.000		0.000
		(1.69)		(1.24)		(0.36)
Acquirer ROE		0.029***		0.013***		0.007
		(3.74)		(2.76)		(0.68)
Acquirer leverage		0.163***		-0.004		-0.029
		(7.16)		(-0.32)		(-0.93)
Acquirer cash flow to asset		0.002		0.000		0.003
		(1.59)		(0.15)		(1.58)
Target public status		0.069***		0.025**		0.035
		(3.89)		(2.44)		(1.47)
Diversification deal		-0.007*		-0.007***		-0.009*
		(-1.96)		(-3.26)		(-1.86)
Cash deal		-0.008**		-0.003		0.003
		(-2.25)		(-1.24)		(0.54)
Constant	0.009***	0.025	0.007***	0.025	-0.004**	0.170*
	(6.23)	(0.33)	(8.51)	(0.57)	(-2.20)	(1.65)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes
Adjusted R square	0.003	0.045	0.003	0.017	0.003	0.011
Number of observations	1128	1128	1128	1128	1128	1128
Panel C: Long-term operation performance of NRIOSOE acquirers						

Post-M&A industry-adjusted return on equity	IAROE_12months		IAROE_24months		IAROE_36months	
	(1)	(2)	(3)	(4)	(5)	(6)
NRIOSOE acquirers	-0.007***	-0.009***	-0.004**	-0.004**	-0.010***	-0.015***
	(-2.71)	(-2.87)	(-2.50)	(-2.11)	(-3.20)	(-3.35)
Acquirer Tobin's Q		0.001**		0.000		0.000
		(1.99)		(1.06)		(0.33)
Acquirer ROE		0.030**		0.013**		0.007
		(2.02)		(2.22)		(0.85)
Acquirer leverage		0.167***		-0.002		-0.023
		(4.48)		(-0.17)		(-0.74)
Acquirer cash flow to asset		0.002***		0.000		0.003**
		(2.80)		(0.18)		(2.14)
Target public status		0.070		0.026**		0.037*
		(1.59)		(2.06)		(1.85)
Diversification deal		-0.007**		-0.007***		-0.009**
		(-2.06)		(-3.25)		(-2.14)
Cash deal		-0.009**		-0.003		0.002
		(-2.26)		(-1.32)		(0.42)
Constant	0.015***	0.034***	0.011***	0.030***	0.005***	0.187***
	(8.70)	(7.00)	(9.00)	(9.89)	(2.70)	(29.44)
Year fixed effects	No	Yes	No	Yes	No	Yes
Industry fixed effects	No	Yes	No	Yes	No	Yes

Adjusted R square	0.002	0.047	0.002	0.018	0.002	0.012
Number of observations	1128	1128	1128	1128	1128	1128

Panel A shows that estimates of the coefficient of the SOE acquirer dummy are insignificant in all cases and are negative when I add control variables. I also find that acquirer's Tobin's Q, leverage, and cash payment are significantly and positively related to only one-year industry-adjusted ROE of the acquirer, that the acquirer's ROE is significantly and positively related to one-year and two-year industry-adjusted ROE of the acquirer, that diversified deals incur significantly less industry-adjusted ROE of the acquirer, and that deals aiming to acquire a public target have a significantly positive effect on the industry-adjusted ROE of the acquirer.

In Panel B, I use the RIOSOE acquirer dummy as the independent variable in the baseline specifications presented in Panel A. In contrast with the result in Panel A, the coefficient estimates of the RIOSOE acquirer dummy are significantly positive in all cases.

In a similar fashion, Panel C reports that the coefficient estimates of the NRIOSOE acquirer dummy are significantly negatively related to industry-adjusted ROEs. I also find that the results of the control variables in these two regressions are consistent with those of regression on the industry-adjusted ROE of the acquirer dummy.
It is thus reasonable to infer from the results in Table 3.6 that the negative post-acquisition industry-adjusted ROE of SOE acquirers is primarily attributable to those RIOSOE acquirers.

3.6 Discussion

3.6.1 Theoretical contribution

Previous works on the impact of M&A on innovation have been examined primarily in western countries (Cassiman *et al.* 2005; Bena & Li 2014). There has been a notable lack of studies, though, on how M&A influences innovation activities and performance within the context of China where the market is intervened on by the government and where state-owned enterprises command dominant status in the economy. I show that state ownership and responsible innovation orientation (a type of innovation exerting the 'right impact' on society) interplay and invoke different post-acquisition innovation patterns. In my study, I empirically examine the role of state ownership and responsible innovation orientation in affecting the growth of post-acquisition R&D expenditure and patent counts, as well as both the short- and long-term performance of such actions.

Previous studies on state ownership and M&A mostly focus on post-acquisition market performance (Zhou *et al.* 2015). However, how state ownership affects post-acquisition innovation activities and performance remains unclear. In contrast with the conventional economic view that state ownership is incompatible with efficiency, which is defined as the degree of transformation of resource input into product output (Shleifer 1998; Megginson & Netter 2001), I argue that financial and political support,

as well as business connections, are beneficial to SOE acquirers in their post-acquisition innovation activities and performance because SOEs with these priorities are less likely to suffer financial shortages and integration problems.

My study is complementary to the literature on government intervention and innovation policy (Guan & Yam 2015; Lenihan *et al.* 2019) as it analyses the innovation efficiency of state-owned enterprise intervened by government and its policy, rather than focusing on the government's direct innovation investment. I show that with government intervention, responsible-innovation-oriented SOEs become more innovative after the acquisition. They undergo a significant increase in R&D spending and in their number of patent applications.

My study also contributes to the literature on sustainable and responsible innovation (Hellström 2003; Owen *et al.* 2013; Von Schomberg 2013) and literature on innovation and firm efficiency (Boeing 2016) by differentiating the changing patterns of pre- and post-acquisition innovation of Chinese SOE acquirers with responsible innovation orientation. I find that the increase in R&D investment following M&A is likely to occur in SOEs that are oriented towards responsible innovation, leading to a negative market reaction in the short term, whereas the increase in patent counts subsequent to M&A is often observed in other SOE acquirers. Nevertheless, both long-term market and operational performance are showing an upward trajectory for SOEs that are oriented towards responsible innovation following M&A. These results suggest that responsible innovation orientation plays an important role in differentiating the growth patterns of R&D spending and patent publications. In other words, I find evidence that SOEs with responsible innovation orientation appear to be inefficient in translating post-acquisition innovation investment into patents, in line with the dominant view 'of incompatible with efficiency' on SOEs (Shleifer 1998; Megginson & Netter 2001). Nevertheless, both long-term market and operational performance are showing an upward trajectory for SOEs that are oriented towards responsible innovation following M&A.

3.6.2 Practical implications

My study has practical implications for shareholders, managers, and policymakers in understanding how state ownership and responsible innovation orientations interplay and jointly affect post-acquisition innovation activities and performance.

For shareholders and investors, it should be expected that responsible-innovation-oriented SOE acquirers may suffer negative market reactions to the announcement of M&A deals due to the fact that a substantial increase in R&D expenditure and a fall in patent counts might follow shortly. However, investors shall note that these acquirers are more likely to outperform others in the long term. For

managers from SOEs with responsible innovation orientation, I should provide a note of caution. Obtaining external resources and capabilities via M&A does not necessarily translate into innovativeness. Managers will be aware of negative market performance around the announcement of the M&A deals and will aim to manage R&D spending effectively subsequent to acquisitions such that it will ultimately lead to patents and final products. For policymakers, the financial and policy support prioritised for SOEs with responsible innovation orientation will continue to follow M&A deals as it may take years for SOEs to realise the synergistic value from M&A for stakeholders and innovate in such a way as to exert the 'right impact' on society.

3.7 Conclusion

In summary, my study shows that state ownership in China drives post-acquisition innovation among acquirers. However, SOE acquirers oriented towards responsible innovation are likely to increase R&D investment following the acquisition but produce fewer patents, thus leading to a negative market reaction in the short term. In the long-term, though, both market and operational performance are showing an upward trajectory for RIOSOE acquirers subsequent to M&A.

The findings of this paper suggest the following new directions for future research. First, my paper highlights the impact of responsible innovation orientation on SOE acquirers' post-acquisition innovation activities within the context of China. Future studies can extend my research to other countries in order to increase the generalisability of my results. Second, I use industry classifications as a proxy for responsible innovation orientation in my study, but future research can explore other proxies in order to validate the link between responsible innovation orientation and industry clusters. Third, I show that state ownership has a positive effect on enterprises' post-acquisition innovation activity in terms of R&D spending and patent publications. Exploring whether and how state ownership facilitates the transformation from patents to new products will be important. Finally, future work can explore whether and how the responsible innovation orientation of target enterprises affects the innovativeness of merging enterprises.

3.8 Appendix A

Variables	Definitions	Source
Panel A: Dependent variables		
Growth rate in patent	The growth rate of the patent count, where the patent is identified as an 'invention', between the three-year period ending one year prior to the bid announcement (i.e. ayr-3 to ayr-1) and the three-year period ending one year after the bid announcement (i.e. ayr+1 to ayr+3), between the two-year period ending one year prior to the bid announcement (i.e. ayr -2 to ayr-1) and the two-year period ending one year after the bid announcement (i.e. ayr+1 to ayr+2), and between the one-year period ending one year prior to the bid announcement (i.e. ayr-1 to ayr) and the one-year period after the year when the bid is announced (i.e. ayr to ayr +1).	CSMAR
Growth rate in R&D spending	The growth rate of R&D spending between the three-year period ending one year prior to the bid announcement (i.e., ayr-3 to ayr-1) and the three-year period ending one year after the bid announcement (i.e. ayr+1 to ayr+3), between the two-year period ending one year prior to the bid announcement (i.e. ayr -2 to ayr-1) and the two-year period ending one year after the bid announcement (i.e. ayr+1 to ayr+2), and between the one-year period ending one year prior to the bid announcement (i.e. ayr-1 to ayr) and the one-year period after the year when the bid is announced (i.e. ayr to ayr +1).	CSMAR

CAR	This measure is constructed following the work of Brown and Warner (1985). The estimation period I used lasts 365 days and ends 4 weeks before the M&A deal announcement. The benchmark is the value-weighted CRSP index.	CSMAR
BHAR	Following Bowman et al (2009), I calculate the buy-and-hold abnormal returns (BHARs) by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of acquirers. There are as many as 50 portfolios, each classified according to their size (market valuation) and book-to-market ratios. Next, I compute the buy-and-hold return for the reference portfolio by compounding the average of return for each portfolio. Finally, I obtain the BHARs by using the buy-and-hold return for each acquirer minus the buy-and-hold return for the reference portfolio.	CSMAR
Panel B: Firm characteristics		
SOE acquirer	Equals one if the acquirer is a state-owned enterprise and zero otherwise. I define state-owned enterprises according to Berkman (2010) and Zhou's (2012) definitions, which state that the largest shareholder of SOEs is a government agency or government institution.	CSMAR
RIOSOE acquirer	Equals one if the acquirer is a state-owned enterprise and belongs to a responsible-innovation-oriented industry, and zero otherwise. I identify responsible-innovation-oriented industries as industries whose characteristics are in line with those of responsible innovation according to Von Shomberg (2013). The RI industries I identified are M73 Research and Experimental Development, M74 Professional Technical	CSMAR

	Service, C37 Railway, Marine, Aerospace and Other Transportation Equipment Manufacturing, N76 Water Conservancy Management, N77 Ecological Protection and Environmental Management, N78 Public Facilities Management, C42 Comprehensive Use of Waste Resources, C27 Pharmaceutical Manufacturing, I63 Telecommunications, Radio, Television, and Satellite Transmission Services, I64 Internet and Related Services, and I65 Software and Information Technology Services.	
NRIOSOE acquirer	Equals one if the acquirer is a state-owned enterprise (SOEs) but in industries excluding those with responsible innovation orientation, and zero otherwise.	CSMAR
Acquirer Tobin's Q	The ratio of market value by the book value of the acquirer's assets. This measure is constructed following Masulis et al. (2007) and Lang et al. (1989)	CSMAR
Acquirers ROE	The ratio of the acquirer's net income by equity.	CSMAR
Industry-adjusted return on equity	Original ROE deducts the median ROE in the bidder's industry with identical first two-digit SIC codes.	CSMAR
Target public status	Dummy variable that equals one if the target is listed on the Shanghai or Shenzhen Stock Exchange, and zero otherwise.	CSMAR
Panel C: Deal characteristics		
Diversification deal	Dummy variable that equals one if the acquirers and targets do not operate in the same industry according to the CSRC industry classification, and zero otherwise.	Thomson One

Public deal	Dummy variable that equals one if the targets were listed during the M&A period, and zero otherwise.	Thomson One
Cash deal	Dummy variable that equals one if the M&A deal was paid entirely by cash, and zero otherwise.	Thomson One

3.9 Appendix B

Table B.1 Endogeneity check

In this table, I adopt 2-stage-least square (2SLS) to test endogeneity and to report the regression results. The instrument variable for state-owned acquirers (SOE) is a dummy variable which equals one if the full name of the acquirers starts with 'China', 'State' or 'Nation'. In Panel A, the dependent variable represents the growth rate in R&D investment against dummy variables related to acquirers. In Panel B, the dependent variable is the growth rate of awarded patent count. In Panel C, I report the 2SLS regression results for acquirers' announcement return. In Panels D and E, the dependent variables represent long-run post-acquisition performance, acquirers' buy-and-hold return, and industry-adjusted return on equity, respectively. In all models, I include control variables and year and industry fixed effects. For brevity, I do not report the results for the industry and year dummies. All variables are defined in Appendix A. Robust t-statistics are reported in brackets. ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: Endogenous analysis for R&D investment

Growth rate in R&D	ΔR&D (-1, +1)		ΔR&D (-2, +2)		ΔR&D (-3, +3)	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
SOE acquirers		0.374**		0.418*		0.536**
		(2.24)		(1.87)		(2.11)
Acquirer Tobin's Q	-0.008***	0.028	-0.008***	0.026	-0.008***	0.069

	(-2.75)	(1.47)	(-2.75)	(1.15)	(-2.75)	(1.33)
Acquirer return on equity	0.016	-0.090	0.016	0.313	0.016	0.301
	(0.21)	(-0.28)	(0.21)	(0.79)	(0.21)	(1.43)
Acquirer leverage	0.055***	-0.167	0.055***	-0.392*	0.055***	-0.537**
	(8.16)	(-1.06)	(8.16)	(-1.84)	(8.16)	(-2.41)
Acquirer cash flow to asset	0.059***	-0.268	0.059***	-0.384*	0.059***	-1.567***
	(2.97)	(-1.45)	(2.97)	(-1.75)	(2.97)	(-2.64)
Target public status	0.159***	-1.191*	0.159***	-1.424	0.159***	-2.636**
	(3.61)	(-1.69)	(3.61)	(-1.46)	(3.61)	(-2.34)
Diversification deal	-0.008	0.246*	-0.008	0.236	-0.008	0.418*
	(-0.39)	(1.84)	(-0.39)	(1.33)	(-0.39)	(1.70)
Cash deal	0.009	-0.003	0.009	0.084	0.009	0.286
	(0.36)	(-0.03)	(0.36)	(0.62)	(0.36)	(1.35)
IV_company name	0.098***		0.098***		0.098***	
	(4.02)		(4.02)		(4.02)	
Constant	0.799***	-2.371*	0.799***	-2.240	0.799***	-2.043

	(15.71)	(-1.81)	(15.71)	(-1.30)	(15.71)	(-1.38)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R square	0.0776	0.0264	0.0776	0.0207	0.0776	0.0644
Number of observations	1128	1128	1128	1128	1128	1128

Panel B: Endogenous analysis for growth in patent count

Growth rate in patent	ΔPatent (-1, +1)		ΔPatent (-2, +2)		ΔPatent (-3, +3)	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
SOE acquirers		0.131**		0.241***		0.129**
		(2.27)		(3.24)		(2.48)
Acquirer Tobin's Q	-0.008***	0.108*	-0.008***	0.105	-0.008***	0.192
	(-2.75)	(1.70)	(-2.75)	(1.40)	(-2.75)	(1.57)
Acquirer return on equity	0.016	1.742	0.016	-0.320	0.016	-1.084
	(0.21)	(1.27)	(0.21)	(-0.87)	(0.21)	(-1.10)
Acquirer leverage	0.055***	-0.779**	0.055***	-1.274***	0.055***	-0.507**
	(8.16)	(-2.40)	(8.16)	(-2.85)	(8.16)	(-2.27)
Acquirer cash flow to asset	0.059***	-0.235	0.059***	-1.225*	0.059***	-0.574
	(2.97)	(-0.49)	(2.97)	(-1.67)	(2.97)	(-1.13)
Target public status	0.159***	0.247	0.159***	-4.659***	0.159***	-2.290**
	(3.61)	(0.11)	(3.61)	(-3.03)	(3.61)	(-2.41)

Diversification deal	-0.008	-0.300	-0.008	0.310	-0.008	0.166
	(-0.39)	(-0.99)	(-0.39)	(0.65)	(-0.39)	(0.53)
Cash Deal	0.009	0.009	0.009	0.191	0.009	0.080
	(0.36)	(0.02)	(0.36)	(0.35)	(0.36)	(0.22)
IV_company name	0.098***		0.098***		0.098***	
	(4.02)		(4.02)		(4.02)	
Constant	0.799***	-10.678**	0.799***	-19.142***	0.799***	-11.790***
	(15.71)	(-2.27)	(15.71)	(-3.33)	(15.71)	(-2.62)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R square	0.0776	0.0655	0.0776	0.0636	0.0776	0.0844
Number of observations	1128	1128	1128	1128	1128	1128

Panel C: Endogenous analysis for acquirers' announcement return

Acquirer announcement return	CAR (-1, +1)		CAR (-2, +2)		CAR (-5, +5)	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
SOE acquirers		-0.124**		-0.090*		-0.134**
		(-2.23)		(-1.74)		(-1.96)
Acquirer Tobin's Q	-0.008***	-0.002**	-0.008***	-0.001	-0.008***	-0.001
	(-2.75)	(-2.47)	(-2.75)	(-1.63)	(-2.75)	(-1.00)
Acquirer return on equity	0.016	-0.007	0.016	-0.014	0.016	-0.000
	(0.21)	(-0.71)	(0.21)	(-1.26)	(0.21)	(-0.02)
Acquirer leverage	0.055***	0.004*	0.055***	0.003	0.055***	0.004*
	(8.16)	(1.84)	(8.16)	(1.37)	(8.16)	(1.72)
Acquirer cash flow to asset	0.059***	0.001	0.059***	0.012**	0.059***	0.018**
	(2.97)	(0.94)	(2.97)	(2.03)	(2.97)	(2.19)
Target public status	0.159***	0.012	0.159***	0.021	0.159***	0.019
	(3.61)	(0.58)	(3.61)	(1.34)	(3.61)	(0.73)

Diversification deal	-0.008	-0.003	-0.008	0.000	-0.008	-0.001
	(-0.39)	(-0.84)	(-0.39)	(0.13)	(-0.39)	(-0.11)
Cash deal	0.009	-0.003	0.009	-0.004	0.009	-0.010
	(0.36)	(-0.78)	(0.36)	(-1.06)	(0.36)	(-1.56)
IV_company name	0.098***		0.098***		0.098***	
	(4.02)		(4.02)		(4.02)	
Constant	0.799***	0.122**	0.799***	0.091**	0.799***	0.135**
	(15.71)	(2.55)	(15.71)	(2.11)	(15.71)	(2.39)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R square	0.0776	0.022	0.0776	0.027	0.0776	0.030
Number of observations	1128	1128	1128	1128	1128	1128

Panel D: Endogenous analysis for acquirers' buy-and-hold return

Post M&A Buy-and-hold abnormal return	BHAR_12months		BHAR_24months		BHAR_36months	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage
SOE acquirers		-1.909		-0.893		-2.191
		(-1.13)		(-0.44)		(-0.75)
Acquirer Tobin's Q	-0.008***	-0.027	-0.008***	-0.014	-0.008***	-0.030
	(-2.75)	(-1.22)	(-2.75)	(-0.55)	(-2.75)	(-0.79)
Acquirer return on equity	0.016	-0.104	0.016	-0.067	0.016	-0.037
	(0.21)	(-1.56)	(0.21)	(-1.29)	(0.21)	(-0.66)
Acquirer leverage	0.055***	0.047	0.055***	0.005	0.055***	0.032
	(8.16)	(1.19)	(8.16)	(0.11)	(8.16)	(0.47)
Acquirer cash flow to asset	0.059***	0.029	0.059***	0.020	0.059***	0.052
	(2.97)	(1.07)	(2.97)	(0.70)	(2.97)	(1.22)
Target public status	0.159***	0.095	0.159***	0.238	0.159***	0.362
	(3.61)	(0.49)	(3.61)	(0.81)	(3.61)	(0.95)
Diversification Deal	-0.008	-0.035	-0.008	0.021	-0.008	-0.058

	(-0.39)	(-0.55)	(-0.39)	(0.27)	(-0.39)	(-0.53)
Cash deal	0.009	0.015	0.009	0.009	0.009	-0.023
	(0.36)	(0.35)	(0.36)	(0.24)	(0.36)	(-0.38)
IV_company name	0.098***		0.098***		0.098***	
	(4.02)		(4.02)		(4.02)	
Constant	0.799***	1.744	0.799***	0.881	0.799***	2.056
	(15.71)	(1.18)	(15.71)	(0.50)	(15.71)	(0.80)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R square	0.0776	0.001	0.0776	0.001	0.0776	0.000
Number of observations	1128	1128	1128	1128	1128	1128

Panel E: Endogenous analysis for acquirers' industry-adjusted return on equity

Post-M&A industry-adjusted return on equity	IAROE_12months		IAROE_24months		IAROE_36months	
	First-stage	Second-stage	First-stage	Second-stage	First-stage	Second-stage

SOE acquirers		-0.052		-0.023		0.090
		(-0.91)		(-0.70)		(1.28)
Acquirer Tobin's Q	-0.008***	0.000	-0.008***	0.000	-0.008***	0.001
	(-2.75)	(0.30)	(-2.75)	(0.46)	(-2.75)	(1.48)
Acquirer return on equity	0.016	0.016	0.016	0.020***	0.016	0.024**
	(0.21)	(0.91)	(0.21)	(3.11)	(0.21)	(2.28)
Acquirer leverage	0.055***	0.005*	0.055***	0.001	0.055***	-0.005
	(8.16)	(1.79)	(8.16)	(0.45)	(8.16)	(-1.63)
Acquirer cash flow to asset	0.059***	0.003**	0.059***	0.001	0.059***	0.003
	(2.97)	(2.01)	(2.97)	(0.82)	(2.97)	(1.63)
Target public status	0.159***	0.057	0.159***	0.026**	0.159***	0.020
	(3.61)	(1.48)	(3.61)	(2.20)	(3.61)	(1.01)
Diversification deal	-0.008	-0.009***	-0.008	-0.006***	-0.008	-0.004
	(-0.39)	(-2.82)	(-0.39)	(-2.76)	(-0.39)	(-0.88)
Cash deal	0.009	0.002	0.009	0.001	0.009	-0.002

	(0.36)	(0.67)	(0.36)	(0.37)	(0.36)	(-0.39)
IV_company name	0.098***		0.098***		0.098***	
	(4.02)		(4.02)		(4.02)	
Constant	0.799***	0.053	0.799***	0.029	0.799***	-0.077
	(15.71)	(1.09)	(15.71)	(1.00)	(15.71)	(-1.27)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R square	0.0776	0.001	0.0776	0.001	0.0776	0.000
Number of observations	1128	1128	1128	1128	1128	1128

Chapter 4: Does Corporate ESG Create Value? New Evidence from M&As in China

4.1 Introduction

Corporate activities that benefit stakeholders (i.e. suppliers, employers, society, and customers) are frequently referred to under the umbrella of corporate social responsibility (CSR). Environmental(E), social(S), and governance (G) form the three pillars through which a firm's sustainability, responsibility, and ethical practices toward stakeholders can be evaluated. Over the last decade, ESG has become an increasingly important part of doing business around the world. Companies are allocating significant portions of their expense budgets to ESG – indeed, upwards of $20 billion was spent on ESG by Fortune Global firms in 2018.[18] Furthermore, more than 90% of the 250 largest companies make ESG reports every year (KPMG 2017)[19] and ESG is also increasingly important to investors, with $86 trillion of professionally managed assets related to ESG coming through socially responsible investing (SRI) in 2019.

With the amount of money and attention that companies are giving to ESG, it is important to understand whether and how ESG pay back? Thus far, only mixed evidence has been produced on the relationship between ESG and firms' financial performance. Some studies view ESG-related expenditure as a waste of valuable resources. They believe that ESG activities reflect managerial agency problems and that ESG-related expenditure results in benefits enjoyed by non-financial stakeholders at the expense of shareholders (Servaes & Tamayo 2013; Masulis & Reza 2015; Buchanan *et al.* 2018). Others, meanwhile, believe that spending on ESG may be financially profitable in certain situations (i.e. (Flammer 2015a; Lins *et al.* 2017; Xiao *et al.* 2018). In line with the instrumental stakeholder theory, this body of literature demonstrated that ESG could be compensated for as firms invest more in ESG (high ESG firms) and thereby earn the trust of stakeholders (i.e. employees, capital providers, and authorities) through a strong

[18] https://www.ictsd.org/how-much-do-uk-companies-spend-on-csr/

[19] https://www.ictsd.org/how-much-do-uk-companies-spend-on-csr/

reputation for honouring implicit contracts[20] (Arouri *et al.* 2019; Cornell & Shapiro 2021), thus encouraging stakeholders to 'purchase' this contract by committing resources and efforts to the firm's operations (Deng *et al.* 2013; Bettinazzi & Zollo 2017; Lins *et al.* 2017; Cornell & Shapiro 2021).

In this paper, I aim to test this 'instrumental stakeholder' view in the context of M&A deals in the Chinese market in order to shed light on the existing debate around the financial benefit of ESG. In an important departure from previous studies, I analyse the impact of both the ESG standards and the dynamics of their relationship with acquirers' M&A performance so that I might understand stakeholders' responses to firms' ESG efforts.[21]

M&A serves as an important event to examine the financial benefit of ESG through the 'instrumental stakeholders' channel for two reasons. First, as one of the most important corporate investment decisions, M&A can have a significant impact on firms' financial performance (Ahern & Weston 2007). Successful M&A brings synergy while unsuccessful M&A leads to losses. Moreover, stakeholders' action is crucial to M&A success (Anderson *et al.* 2012; Meglio 2016). Both the approval process and integration process of M&A is

[20] Corporations represent a nexus of implicit and explicit contracts between shareholders and stakeholders (Coase 1937; Fama & Jensen 1983; Shleifer & Summers 1988). Explicit contracts refer to those contracts that have legal binding whereas implicit contracts have no legal binding. For implicit contracts, firms can fail to deliver on their promise without being sued by other stakeholders, meaning that the value of implicit contracts depends on trust. Indeed, high-CSR firms have a reputation for being trustworthy and reliable and are therefore expected to commit to implicit contracts (Kristoffersen et al. 2005; Liang et al. 2017).

[21] ESG variations are related to firms' CSR/ESG efforts (Benlemlih et al. 2018). For firms with high ESG scores, a downgrade in their CSR ratings may signal a relaxation of their CSR efforts and, consequently, a deterioration in their CSR legitimacy. By contrast, for firms characterised by low CSR scores, an upgrade in their CSR ratings may be viewed as an intensification of their CSR efforts and an attempt to restore their CSR legitimacy.

frequently subject to a range of challenges as well as support from various stakeholders (Shleifer & Summers 1988; Rhodes-Kropf & Robinson 2008; Dessaint *et al.* 2017; Arouri *et al.* 2019; Masulis *et al.* 2020). Consistent with this view, reports by A.T. Kearney (Kearney 1999), KPMG (Kelly 1999), and Booz Allen Hamilton (Adolph *et al.* 2001) show that continued customer service and talent retention are important to the success of M&A, which highlights the importance of stakeholders in M&A. Second, since M&As are typically unpredictable occurrences, including M&A performance in the study may help to alleviate the reverse causality issue that has plagued past research into the relationship between CSR/ESG and firms' financial performance (Waddock & Graves 1997; Teoh *et al.* 1999; McWilliams & Siegel 2000; Jiao 2010). For example, firms with good performance could invest more in ESG so that firms with high ESG demonstrate high Tobin's Q or good accounting performance (McGuire *et al.* 1988 1988). This concern is partially alleviated by using buy-and-hold returns associated with unexpected events such as M&A.

I first propose that high ESG acquirers will enjoy better post-M&A performance. As the instrumental stakeholder view suggests that firms with a high ESG level earn the trust of stakeholders and secure support from them, deals announced by high ESG acquirers are more likely to be supported by stakeholders. With the support of stakeholders, the integration process will be subject to less uncertainty (Arouri *et al.* 2019) and operate at higher efficiency (Deng *et al.* 2013; Bettinazzi & Zollo 2017; Liang *et al.* 2017), thereby leading to higher synergies (i.e. the extra value of the combined firm vis-à-vis the sum of the values of the acquiring and acquired firms independently).

In terms of the dynamics of ESG efforts (ESG upgrade or downgrade) on post-M&A performance, I propose the initial ESG standard dependent view. According to this view, the financial benefit of a marginal increase in ESG score is dependent on the acquirer's initial ESG

standard. This implies that high-ESG acquirers who experience a drop in ESG may underperform, whereas low-ESG acquirers who experience an increase in ESG may overperform. This view is in line with the law of diminishing marginal utility (DMU) which indicates that stakeholders' satisfaction with and trust in firms decreases with a marginal increase in welfare (Kauder 2015). According to this theory, for a firm with a high standard of stakeholder welfare (a high-ESG- score firm), an increase in ESG score has a limited effect on the utility of its stakeholders, implying a limited increase in stakeholders' trust and contribution to operations, whereas a decrease in ESG score results in a significant decrease in stakeholder utility, implying a decrease in stakeholders' contributions to operations. On the other hand, for a firm with a low standard of stakeholder trust and welfare (a low-ESG-score firm), an increase in ESG score has a significant effect on the utility of its stakeholders, implying a significant increase in stakeholders' trust and contribution to operations, whereas a decrease in ESG score results in a limited decrease in stakeholder utility, implying a limited decrease in stakeholders' contributions to operations. Similarly, this mechanism could be reflected in stakeholders' support for a firm's M&A process and therefore it could also be reflected in post-M&A performance. Therefore, I predict that a downgrade in ESG is negatively related to post-M&A performance for acquirers with a high initial ESG performance level and that an upgrade in ESG is positively related to post-M&A performance for acquirers with a low initial ESG performance level.

Using a sample of 1,489 completed domestic M&A deals of 847 Chinese firms from 2011 to 2019, I find strong evidence that acquirers' ESG performance ratings have a significant positive effect on their one-year-post-M&A stock returns and post-merger operating performance. These results are consistent with my first conjecture. In addition, I find that for firms with a high initial ESG rating, a rating upgrade will not lead to better post-M&A performance, but a downgrade will lead to worse post-M&A stock and operating performance. Meanwhile, for firms with a low initial ESG rating, a rating upgrade will lead to better M&A stock and

operating performance, but a downgrade has no significant impact on M&A performance. This result is consistent with the initial ESG performance dependent view based on stakeholder utility decrease theory. My evidence is robust to a battery of tests, including fixing the alternative industry effect, regression with more controls, and two-stage least squares (2SLS) with instrumental variables to address potential endogeneity. Finally, I show that acquirers who have a high ESG rating or who start with low ESG and experience an ESG rating upgrade are more likely to complete the deal.

My study makes contributions to the literature in three dimensions. First, my paper contributes to the literature investigating whether and how firms' ESG investment is paid back. For instance, Lins *et al.* (2017) focus on the trust level among participants in the financial market and demonstrate that corporate ESG pays off when the overall level of trust in corporations and markets suffers a negative shock (i.e. during a financial crisis). Additionally, Ding *et al.* (2021) provide evidence from firms in 61 economies that ESG has paid off during the COVID-19 pandemic. Finally, Xiao *et al.* (2018) highlight the sustainability performance of the countries and discover that enterprises in countries with higher levels of sustainability performance often find it more difficult to capitalise on ESG than their counterparts in countries with relatively low levels of ESG. My results emphasise the impact of stakeholders' utility and firms' major investment activity.

Second, my research supplements studies on the functions of corporate social capital and post-M&A performance. The paper closest to mine is that of Deng *et al.* (2013), who study a sample of US merger deals and find that M&A operations by high ESG acquirers take less time to complete, are less likely to fail than M&A operations by low ESG acquirers, and realise higher merger announcement returns and higher post-merger long-term operating and stock performance. I advance this strand of the literature in two ways. First, I provide evidence from a developing country. More specifically, I analyse M&A deals in the world's largest developing

country (i.e. China). This developing country perspective is particularly important for three reasons. (1) China has a high potential for and determination to undertake ESG performance but receives less attention. (2) Scholars have already devoted much attention to unpacking the financial benefit of ESG in the U.S. context (Deng *et al.* 2013; Lins *et al.* 2017), but I know less about it in other contexts. Studying the financial benefit of ESG in the Chinese M&A market, therefore, adds to the empirical body of work on the rationale for firms' ESG activity. Moreover, (3) China constitutes the world's second-largest economy, so it seems reasonable to extend research into firms' ESG activity in this country. Second, I consider the impact of the dynamics of ESG as reflected in a firm's ESG effort, its stakeholders' utility, and the stakeholders' support in the firm's operations. Another work that is related to my study is that of Liang *et al.* (2017) who investigate the impact of acquirers' engagement in employee issues in the M&A context. My study differs from theirs in that I analyse all aspects of ESG (i.e. environment, social, and governance) and its dynamics rather than just employee relations.

Finally, my research contributes to the strand of literature considering the role of stakeholders' utility in the ESG value creation process (Harrison *et al.* 2010; Garriga 2014). According to Harrison *et al.* (2010), the stakeholder utility function is an adequate concept to represent stakeholder welfare, while different value expectations included in stakeholder utility functions lead to different opportunities for value creation for the firm. I extend this theory by considering the stakeholder marginal utility of firms' ESG activity change.

The paper proceeds as follows. Section 2 introduces related theories and establishes my main hypothesis. Section 3 describes the data and provides summary statistics for the variables of interest. In Section 4, I outline the empirical methodology and discuss my empirical results. And in the final section, I summarise and conclude the paper.

4.2 Literature review

In this section, I review the previous literature on the valuation effect of corporate ESG activity and, additionally, the relationship between firms' stakeholder and M&A performance.

4.2.1 ESG/CSR and firms' financial performance

One of the biggest controversies in all types of ESG literature is whether management decisions about corporate responsibility have an effect on firm performance and value. The empirical research into the association between CSP and corporate financial performance (CFP) has produced a range of favourable, non-significant, and even negative findings (Margolis *et al.* 2007; Flammer 2015b). Certain theoretical studies (Baron 2007; Benabou & Tirole 2010; Fatemi *et al.* 2015; Albuquerque *et al.* 2019) suggest that increased ESG/CSR performance may boost company value. In contrast, it has been claimed that ESG activities may lead to managerial agency issues and that corporate executives participate in these activities in order to maximise their personal utility rather than the welfare of shareholders, implying a negative association between ESG and company performance.

Negative impact

Some empirical studies support the view that ESG/CSR activities do not serve the interests of shareholders but rather an outcome of agency problems.

Di Giuli and Kostovetsky (2014) investigate the relationships between changes in firms' ESG/CSR ratings (as evaluated by KLD scores) over a three-year period and revenue growth. They discover no statistically significant correlation. Additionally, they discover a substantial negative correlation between changes in firms' ESG/CSR ratings and changes in ROA or stock returns over a three-year period. They interpret these findings (with caution) as implying that 'any advantages to stakeholders from social responsibility occur directly at the price of

corporate value'. Additionally, they argue that when corporations strengthen their ESG/CSR practices, the effect is future stock underperformance and long-run ROA degradation. They suggest that stock underperformance is the consequence of 'a direct market response to ESG/CSR with a lag caused by investors' delayed understanding of CSR regulation changes.

Buchanan *et al.* (2018) utilise the Bloomberg ESG rating, which quantifies the quality of ESG disclosure rather than ESG quality, to assess a firm's CSR traits. They discover a negative and significant coefficient estimate on an interaction term between their ESG measure, crisis indicators, and Tobin's Q after defining a binary categorisation of high vs poor ESG/CSR performance depending on whether companies disclose or not. They find that when agency conflicts became more acute during the financial crisis, the costs associated with excessive ESG/CSR investment drove higher-scoring ESG enterprises to incur bigger decreases in company value.

Some further studies generate doubts regarding the advantages of ESG/CSR operations for all firms, forms of ESG/CSR, and economic environment. Masulis and Reza (2015) argue that the stock market responds unfavourably to corporate philanthropy announcements, implying that investors do not appreciate this form of ESG/CSR activity. Moreover, Servaes and Tamayo (2013) discover a conditional relationship between ESG/CSR qualities and company value for enterprises with varying levels of advertising. They find that ESG/CSR investments are either detrimental to or irrelevant to company value in enterprises that do not promote. As described below, they demonstrate that ESG/CSR efforts help advertising businesses.

No significant effect

Hsu *et al.* (2021) suggest that whether Tobin's Q or long-term profitability are used to quantify shareholder value for state-owned enterprises, their environmental decisions have no meaningful relationship with shareholder value.

Humphrey *et al.* (2012), whose research also indicates that there is no correlation, utilise a proprietary CSP ratings database for UK enterprises and conclude that there are no significant variations in risk-adjusted performance between UK firms with high or low CSP ratings. They conclude that 'investors and managers may apply a CSP investment or business strategy with little or no financial cost (or gain) in terms of risk or return'.

Positive impact

Several studies document a positive relationship between firms' ESG/CSR ratings and measures of firms' financial performance or firm value. Gillan *et al.* (2010), for instance, examine the association between firms' ESG ratings and firm performance using the seven KLD categories and find that companies with higher ESG ratings have higher operating performance and Tobin's Q. Furthermore, Borghesi *et al.* (2014) observe higher KLD scores for firms with stronger operating performance and firms with greater free cash flow. Using six of the seven KLD categories (corporate governance, community, diversity, employee relations, environment and product, omitting human rights), Gao and Zhang (2015) identify a positive correlation between firm-level ESG/CSR scores and Tobin's Q. Also focusing on Tobin's Q, Ferrell *et al.* (2016) find a positive relationship between ESG/CSR scores and firm value and extend their analysis to show that having higher ESG/CSR performance attenuates the negative relationship between managerial entrenchment and value. Iliev and Roth (2021), meanwhile, estimate that director-driven increases in firms' ESG/CSR activities cause improvements in ROA and other measures of operating performance.

Studies draw conclusions regarding the positive effects of ESG/CSR through evidence on a positive relationship with stock returns. For example, Dimson *et al.* (2015) observe positive returns following successful investor engagements that address ESG/CSR concerns. With a similar focus on stock returns, Edmans (2011) supports the view that ESG/CSR actions create

value, finding that the sign of the relation between returns and ESG/CSR performance (as measured by employee satisfaction) is positive. He concludes that ESG/CSR firms have high stock returns that slowly diminish over time as intangibles (specifically good treatment of employees) are initially mispriced but become correctly priced as they transfer into tangible benefits (earnings surprises). Cornett *et al.* (2016) examine a sample of U.S. banks and estimate a positive relationship between ESG/CSR scores and banks' return on equity.

Another approach to the value question is that taken by Chang *et al.* (2019), who analyse the relationship between firm value and ESG/CSR practices by examining whether the value of an additional dollar in cash holdings is greater for high-ESG/CSR firms than for low-ESG/CSR firms. They find that an additional dollar of cash results in larger changes in firm value for firms with high ESG/CSR scores than those with low scores and conclude that ESG/CSR activities result in higher firm value. Furthermore, Liang and Renneboog (2017) use a global sample of firms and an instrumental variables approach (using peers' donations as instruments for the focal firm's donations) to find that charitable donations lead to high firm value and operating performance, which contrasts with the evidence presented by Masulis and Reza (2015).

Several papers approach the estimation of a ESG/CSR-value relation by examining short-term market reactions to ESG/CSR events. Statman and Glushkov (2009) explore whether portfolios of firms with higher ratings outperform firms with lower ratings, thus implying a test of ESG/CSR ratings and firm value. Using KLD ratings for a U.S. firm sample, the authors observe a positive relationship between ESG/CSR ratings and firm performance. These results should be contrasted with those of Humphrey *et al.* (2012) cited earlier who, in the U.K. stock market, find no difference between firms with high or low ESG/CSR ratings and firms' financial performance. Krüger (2015) analyses stock market reactions to over two thousand positive and negative sustainability events for U.S. firms and finds important differences between the two types of events. Most notably, his analysis shows that negative sustainability

events result in a strong negative market reaction, with the strongest reactions being to events that concern the environment or communities. He does not find any significant market reaction for positive events. He also finds that the information content of positive and negative sustainability events is very different. A systematic textual analysis showed that in comparison to positive events, negative events contain more legal and quantitative information and seem to contain more 'hard' information. He concludes that his results are consistent with the view that unsustainable corporate behaviour is costly for shareholders. Flammer (2015b), meanwhile, uses a regression discontinuity design (RDD) to examine the stock reaction to ESG/CSR proposals that pass by a small margin and finds that such 'close call' proposals are associated with positive abnormal returns. Additional analysis by Flammer leads her to conclude that these shareholder proposals create value through their effects on labour productivity and sales. Deng *et al.* (2013) approach the value effect question by examining merger announcement returns for high- versus low-ESG/CSR firms. The authors argue that a merger announcement is an unexpected event that allows the researcher to use the announcement returns to potentially mitigate reverse causality problems between ESG/CSR and firm value that are common to the literature. They also argue that the reputation of a firm in following through on its implicit contracts should be related to its ESG/CSR reputation and expressed during the merger process itself. Based on the positive market reactions to the firms with higher ESG/CSR scores, the authors conclude that ESG/CSR improves firm value.

Two studies take the approach of examining equity market returns upon a firm's issuance of green bonds (fixed income securities issued to fund environmentally friendly projects). Although they contribute to the environment and possibly to a firm's ESG rating, these bonds are not necessarily issued by firms with high ESG/CSR ratings. Tang and Zhang (2020) explore whether the issuance of green bonds is beneficial to a firm's existing shareholders. They observe positive stock market reactions for firms that announce they are issuing green bonds, and, subsequently, these firms exhibit increased stock liquidity and increased institutional

ownership. Consistent with these results, Flammer (2021) also concludes that the issuance of green bonds is associated with positive stock market reactions and changes in firms' real ESG/CSR activities.

Other studies, similarly, show that CSR will lead to positive firm performance in certain conditions. The first condition is a high level of market awareness. According to Servaes and Tamayo (2013) study, ESG/CSR performance creates value but only for firms with high advertising expenses. Albuquerque *et al.* (2019) also find a relation between firm value and ESG/CSR attributes for firms that advertise. They interpret this to be consistent with the view that firms with high product differentiation benefit from ESG/CSR activities. Secondly, market environment is also important. For example, Lins *et al.* (2017) consider the performance of ESG/CSR firms particularly during periods of crisis in which trust in corporations is low. They find that ESG/CSR firms have higher operating performance and earn higher returns relative to other firms during periods of low trust. Meanwhile, Xiao *et al.* (2018) indicate that corporate sustainability performance is positively related to firm value when country-level sustainability performance is low and explain that this is because stakeholders will take a firm's sustainability improvement for granted in countries with good social and environmental performance. Finally, studies also show that activism among shareholders is important. For instance, Barko *et al.* (2021) study the returns of firms that are targeted by activist shareholders promoting ESG improvements. Their results indicate that firms experiencing these ESG engagements earn higher returns than non-engaged peer firms.

In general, the corporate finance literature on ESG/CSR and firm value and performance has produced findings that are relatively mixed. Many, but not all, papers conclude that a positive relation exists between a firm's ESG/CSR performance and firm value or financial performance.

4.2.2 Stakeholders and M&A performance

In this section, I review the literature on the role of stakeholders in firms' M&A activity. The starting point is the stakeholder-based view of the firm which holds that an organisation can be seen as a set of interdependent relationships between its stakeholders (Blair & Stout 1999; Freeman 2010) who are jointly committed to its success and who contribute specific forms of capital, including financial, human, and social capital (Kochan & Rubinstein 2000) to that end. Several definitions of stakeholders have been used in the literature. In this study, I adopt Post *et al.* (2002) definition, which describes a firm's stakeholders as those 'individuals and constituencies that contribute, either voluntarily or involuntarily, to its wealth-creating capacity and activities'. In line with this definition, I focus on those stakeholder groups that 'the firm needs in order to exist' (Dunham *et al.* 2006 2006: 25)): employees, customers, suppliers, and community (i.e. government).

M&A occurs when two organisations relatively equally share their cultural values, liabilities, and available assets across different industries and businesses, referred to as mergers, or when one of the organisations takes over and buys the operations from the other organisations, referred to as acquisition (Gaughan 2010; Vazirani 2012). The main reason for an M&A is that it enables two separate companies to create more value together than they would if they remained individualised (Boruah 2018). At the same time, the combination of two firms is likely to unsettle key stakeholders in a firm because it can disrupt the existing relationships between firms and their stakeholders (Cen *et al.* 2016). In this case, the acquiring firms may experience a loss of resources from these stakeholders (Håkanson 1995; Puranam *et al.* 2009; Junni & Sarala 2013), thus affecting the value creation of the deal.

Several studies document the importance of certain stakeholders in M&A performance. For example, Cording *et al.* (2014) argue that employees' trust in a firm is essential to post-M&A productivity as it affects outcomes for firm performance.

Considering employee engagement, Liang and Renneboog (2017) show that stronger employee engagement – especially in terms of monetary benefits – by the acquiring firm is positively related to shareholder returns in domestic deals. They also find that most of the effects of employee engagement on shareholder returns are driven by the acquirer rather than the target, and that they persist in the long run post merger.

In addition, customers are shown to have an impact on a firm's M&A performance. They represent extensive value for firms in terms of future revenues (Koller *et al.* 2010) and through investments made to them (Hallen *et al.* 1991). Öberg (2018) shows that firms' customers become important 'assets' (Anderson *et al.* 2001) to consider in M&A integration and may thereby affect integration decisions, not merely the outcome of the integration.

Finally, previous literature considers the role of government in M&A activity. Zhou *et al.* (2015) analyse the positive impact of the acquiring firm's government relationship on post-M&A performance. By analysing domestic Chinese acquisition transactions, they show that state-owned acquirers, who have strong connections with the nation of China, are more likely to receive financial and policy support and therefore outperform others.

4.3 Hypothesis development

This section serves two purposes. First, I review the theories that I have referred to in the paper. In addition, I develop my main hypothesis about the firm's ESG and post-M&A performance.

4.3.1 Theoretical background

My theoretical model for a firm's ESG level, ESG dynamics, and its financial benefit in M&A is constructed based on instrumental stakeholder theory (IST) and the law of diminishing marginal utility (DMU).

Instrumental stakeholder theory

IST models the relationship between ESG activity, stakeholders, and firm value (see (Jones 1995). It considers the performance consequences of firms having highly ethical relationships with stakeholders, as reflected in firms' ESG performance. The core hypothesis of IST is that developing stakeholder relationships governed by the norms of traditional ethics – for example, fairness, trustworthiness, loyalty, care, and respect (Hendry 2001, 2004) – will lead to improved financial performance. As summarised by Jones (1995), IST holds that 'firms that contract (through their managers) with their stakeholders on the basis of mutual trust and cooperation will have a competitive advantage over those that do not' (1995: 422). This implies that firms' ESG activities have a positive effect on firm performance because focusing on the interests of other stakeholders increases their willingness to support a firm's operations, which in turn increases firm value.

IST is in line with contract theory, which views a firm as a nexus of contracts between shareholders and other stakeholders in which each group of stakeholders supplies the firm with critical resources or effort in exchange for claims outlined in explicit contracts (e.g. wage contracts and product warranties) or suggested in implicit contracts (e.g. promises of job security to employees and continued service to customers) (Coase 1937; Fama & Jensen 1983; Shleifer & Summers 1988). Firms that invest more in ESG (high ESG firms) tend to have a stronger reputation for keeping their commitments associated with the implicit contracts (Kristoffersen *et al.* 2005; Liang *et al.* 2017), thus increasing the value of the implicit contract (Cornell & Shapiro 1987). In order to 'purchase' this implicit contract, stakeholders are likely

to contribute more resources and effort to the firm. Thus, these theories suggest that firms' ESG efforts are likely to lead to financial payback through stakeholders' support.

Law of diminishing marginal utility

In terms of the model for firms' ESG dynamics and their financial benefits in M&A, I apply the law of diminishing marginal utility (DMU). The law of DMU indicates that when consumers acquire more units of a good, the marginal utility of the last unit acquired will often be diminished (Kauder 2015). According to the law of DMU, as the stimulus continues, the utility of the new consumption is increasingly trivial (Venaik & Brewer 2010). In the context of ESG activities, the initial stages of a service enterprise's ESG activities give stakeholders a greater incentive to contribute to the firm, thereby increasing financial performance. Taking one type of stakeholder as an example, firms' ESG activities give consumers a greater incentive to invest in the brand, along with positive emotions, and thus provide consumers with a perception of the firm's legitimacy, thereby increasing loyalty (Li *et al.* 2017). However, according to the law of DMU, over time, as stakeholders face the continued increase of firms' ESG activities, their positive psychological emotions will inevitably decrease, leading to a decline in the effectiveness of ESG activities (Li 2019). Thus, the ESG activities that promote organisational financial benefits are gradually weakened.

4.3.2 ESG and post-M&A performance

According to instrumental stakeholder theory, good ESG performance has a strong reputation for honouring implicit contracts with stakeholders, increasing the trust from them, and earning financial profit through stakeholders' contributions to firms' operations (Cornell & Shapiro 1987; Freeman ; Jawahar & McLaughlin 2001; Jensen 2001a; Freeman *et al.* 2004 2004; Bettinazzi & Zollo 2017; Lins *et al.* ; Jones *et al.* 2018). In the context of unsettling events such as M&A, stakeholders (e.g. employees, customers, suppliers, and the community at large)

matter (Clark & Geppert 2011). Indeed, since the process of M&A is frequently subject to a range of challenges, support from various stakeholders is important to M&A synergy creation (Shleifer & Summers 1988; Rhodes-Kropf & Robinson 2008; Dessaint *et al.* 2017; Arouri *et al.* 2019; Masulis *et al.* 2020).

First, in the approval stage, deals announced by high- ESG firms are less likely to receive opposition from stakeholders, thus reducing the M&A uncertainty and thereby the cost of the uncertainty (Arouri *et al.* 2019). Target stakeholders could protest and lobby against a takeover conducted by an acquirer perceived to be socially irresponsible (low- ESG acquirer), potentially convincing the board to consider alternatives to the takeover (Liang *et al.* 2017). In addition, high-ESG acquirers could also enjoy a better reputation among regulators (Hong & Liskovich 2015), reducing the risk and the cost of regulatory intervention during the M&A process.

Secondly, in the integration process of M&A, the deal announced by high ESG acquirers will have higher efficiency, which may lead to higher synergies (i.e. the extra value of the combined firm vis-à-vis the sum of the values of the acquiring and acquired firms independently). The McKinsey report (Bekier *et al.* 2001) shows that, during an M&A's transition period, key employees or customers from both acquirers and targets could leave if the management team fails to effectively handle stakeholder relations. As such, after the transaction, low ESG acquirers could suffer a reduction in firm value. High ESG acquirers are less likely to experience such loss of key employees and customers as they have trust and loyalty from these stakeholders.

Therefore, firms with high ESG performance will have better post-M&A performance.

H1: Corporate ESG performance is positively related to the acquirer's post-M&A performance.

4.3.3 ESG dynamics and post-M&A performance

Apart from the role of corporate ESG achievement in corporate value creation during M&A, I also study the impact of ESG upgrades or downgrades prior to M&A on post-M&A performance. To this end, the initial ESG standard dependent view is proposed. According to this view, the financial benefit of a marginal increase in ESG score is dependent on the acquirer's initial ESG standard. This implies that high-ESG acquirers who experience a drop in ESG may underperform whereas low-ESG acquirers who experience an increase in ESG may overperform. This view is in line with the law of diminishing marginal utility (DMU) which indicates that stakeholders' satisfaction with and trust in firms decreases in line with a marginal increase in welfare (Kauder 2015).

According to DMU, for a firm with a high standard of stakeholder welfare (a high-ESG-score firm), an increase in ESG score has a limited effect on the utility of its stakeholders, implying a limited increase in stakeholders' trust in and contribution to operations, whereas a decrease in ESG score results in a significant decrease in stakeholder utility, implying a decrease in stakeholders' contributions to operations. On the other hand, for a firm with a low standard of stakeholder trust and welfare (a low-ESG-score firm), an increase in ESG score has a significant effect on the utility of its stakeholders, implying a significant increase in stakeholders' trust in and contribution to operations, whereas a decrease in ESG score results in a limited decrease in stakeholder utility, implying a limited decrease in stakeholders' contributions to operations. There are useful real-world examples to illustrate this point, such as Haidilao (HKG: 6862). This firm was once renowned for its excellent customer service and generous employee benefits, but it experienced a boycott by customers and a significant drop in revenue due to its decision to significantly increase service fees during the COVID-19 pandemic. Another example is Hongxing Erke. Despite its subpar profitability and inadequate initial ESG performance, it was able to garner stakeholder support and sell out its stock merely by donating money to help mitigate the devastating impact of China's floods.

Similarly, this mechanism could be reflected in the support of stakeholders for firms' M&A processes and thereby in the post-M&A performance. Therefore, I predict that ESG downgrade is negatively related to post-M&A performance for acquirers with a high initial ESG performance level and that ESG upgrade is positively related to post-M&A performance for acquirers with a low initial ESG performance level.

H2a: For acquirers with high initial ESG performance, ESG downgrade is negatively related to post-M&A performance whereas ESG upgrade has insignificant impact on post-M&A performance.

H2b: For acquirers with low initial ESG performance, ESG upgrade is positively related to post-M&A performance whereas ESG downgrade has insignificant impact on post-M&A performance.

4.4 Data, summary statistics, and empirical model

In this section, I discuss the variables, data, and sample characteristics. I also outline the regression models I used to analyse the impact of the acquirer's CSR/ESG and its relationship with post-M&A performance.

4.4.1 Variables

Measures of post-M&A performance

In this paper, I use two types of measure to capture post-M&A performance. One is the post-M&A stock performance, proxied by one-year buy-and-hold abnormal returns (BHARs). The BHAR essentially indicates the excess return over the market that an investor buying the shares of the acquiring company will be enjoying if he or she made the purchase in the month of the

acquisition. In terms of the construction of BHARs, I follow the methodology of Lyon *et al.* (1999). To do this, I first construct a reference portfolio as a benchmark. The returns of this reference portfolio $R_{ref,T}$ are calculated as follows:

$$R_{ref,T} = \sum_{i=1}^{n_s} \frac{[\prod_{t=s}^{s+T}(1 + R_{i,t})] - 1}{n_s} (1)$$

where $R_{i,t}$ is the arithmetic return of the acquirer of deal i in month t , $n_s$is the number of stocks in the portfolio in the beginning month s, and T is the length of the holding period. I then calculate the BHAR for each acquirer over a one-year, two-year, and three-year period after the announcement date using the following equation:

$$BHAR_i = \prod_{t=s}^{s+T}(1 + R_{i,t}) - R_{ref,T} - 1(2)$$

Where $R_{i,t}$ is the simple return of the acquirer of deal i in month and $R_{ref,T}$is the return of the reference portfolio over the holding period *t*.

Another type of metric is one that is based on post-M&A accounting performance. Several related measures have been used in extant literature (Hitt *et al.* 1998; Haleblian & Finkelstein 1999; Schoenberg 2006; Zollo & Meier 2008; Papadakis & Thanos 2010). The rationale for using accounting-based measures to evaluate post-M&A performance relies on the assumption that most deals are geared toward delivering higher performance for merging firms and this synergy between firms is best observed by looking at long-term accounting measures such as the return on assets (Hitt *et al.* 1998; Papadakis & Thanos 2010; Thanos & Papadakis 2012b). Thanos and Papadakis (2012a) suggest that one of the prime motives of M&As is to exploit the potential synergies between the merging companies and that most of these synergies take a number of years to fully realise. Thus, M&A performance can be visible in accounting-based measures over a period of time. Moreover, authors have argued that using multiple measures in a single study provides a more holistic view of post-M&A performance (Thanos & Papadakis 2012a). Hence, following Bertrand and Betschinger (2012), Papadakis and Thanos (2010), and Zollo and Meier (2008), I calculate two measures of post-M&A performance: the one-year post-

M&A return on assets (ROA) and the one-year post-M&A return on equity (ROE), measuring the acquiring firm's profitability. To construct post-M&A return on assets (ROA) and post-M&A return on equity (ROE), I utilise net profit scaled by the book value of assets for ROA and equity for ROE.

Corporate ESG measurements

To proxy Chinese acquirers' ESG performance, I utilise the Sino-Securities Index (SSI) ESG Rating Database. The evaluation method used by the SSI ESG database outperforms other publicly available ESG data for Chinese firms for three reasons. First, it is tailored to Chinese listed firms' ESG efforts. The creation of SSI ESG ratings is based on the international mainstream ESG system and integrates metrics representing Chinese characteristics, such as poverty alleviation, social responsibility reporting, and fines. Additionally, the SSI ESG ratings cover all A-share listed companies dating as far back as 2009, which helps to provide a significant breadth and depth of data. The SSI database collects over 130 bottom-level variables for each firm and synthesises them into 26 indicators for three-dimensional performance, covering the environment, society, and governance. The final ESG score represents this performance across three dimensions. Finally, in terms of data updating, the SSI ESG rating employs a combination of regular evaluation and dynamic tracking to ensure that data is updated on a quarterly basis and accurately reflects the ESG performance of publicly traded firms.

Based on SSI ESG rating data, I create measurements for firms' ESG achievement: ESG rating, spanning from 1 to 9. Given that the SSI ESG rating is ranked from C to AAA, I grant the SSI ESG rating C a value of 1, CC a value of 2, CCC a value of 3, and so on, until AAA is given a value of 9. Throughout my study, I refer to firms with an ESG rating of greater than 6 (A) as high-ESG firms because they are recognised as leaders by SSI's ESG evaluation system.

I also construct two main variables – ESG upgrade and ESG downgrade – to capture the dynamics of corporate ESG performance over time. ESG upgrade is a dummy variable that equals one if a firm undergoes an ESG rating upgrade from the previous year to the current year and zero otherwise. Similarly, ESG downgrade is a dummy variable that equals one if a firm undergoes an ESG rating downgrade from the previous year to the current year and zero otherwise.

Control variables

The control variables in my baseline analysis include firm and industry-specific characteristics derived from the literature (Masulis *et al.* 2007; Deng *et al.* 2013), such as firm size (firm size, the natural logarithm of total assets), market-to-book ratio, leverage, cash holdings, and a state-owned enterprise (SOE) dummy, all of which have been shown to affect corporate ESG and post-M&A performance. Additionally, I include transaction-specific control variables such as the mode of payment, the deal size (the natural logarithm of the deal value), and a diversification dummy indicating the acquisition's industry relatedness. These variables have been utilised to examine the relationship between ESG and post-M&A synergy in the literature (Deng *et al.* 2013; Arouri *et al.* 2019; Doukas & Zhang 2021). The Appendix provides the control variable definitions.

4.4.2 Sample selection and summary statistics

My sample consists of 1,489 Chinese M&A deals between 2011 and 2019. The initial sample of mergers comes from the China Stock Market & Accounting Research (CSMAR) database. My final sample includes all completed domestic M&As that meet the following five selection criteria: (1) the deal value disclosed is greater than ¥5 million yuan; (2) the targets of the deal

are not plant or the right to use land; (3) the deal is completed by the end of 2019; (4) the acquirer is publicly traded and has stock return and financial data available from the CSMAR; (5) the acquirer is in the SSI ESG rating database; and (6) neither the acquirer nor the target is in the financial industries as classified by the China Securities Regulatory Commission (CSRC). These restrictions result in a final sample of 1,489 successful M&As made by 847 firms.

In Panel A of Table 4.1, I present the distribution of my sample M&As according to acquirer industry and year. The number of M&As in each year increases more or less monotonically. Most of the acquirers are in the manufacturing (66.96%) and services (8.39%) industries. Panel B of Table 4.1 presents the distribution of my sample M&As according to acquirer ESG level and year. Most of the acquirers have an ESG rating of 'BBB' (51%).

Table 4.1 Sample distribution

This table presents acquisition sample distributions by year and industry (Panel A) and by year and ESG (Panel B) The sample consists of 1,489 completed Chinese domestic M&A deals between 2011 and 2019. The initial sample of mergers comes from the China Stock Market & Accounting Research (CSMAR) database. My final sample includes all completed domestic M&As that meet the following five selection criteria: (1) the deal value disclosed is greater than ¥5 million yuan; (2) the targets of the deal are not plant or the right to use land; (3) the deal is completed by the end of 2019; (4) the acquirer is publicly traded and has stock return and financial data available from the CSMAR; (5) the acquirer is in the SSI ESG rating database; and (6) neither the acquirer nor the target is in the financial industries as classified by the China Securities Regulatory Commission (CSRC). Industry classification is collected from the China Securities Regulatory Commission (CSRC) classification 2012.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Total	73	138	339	180	126	114	141	158	220	1489
Panel A: Sample distribution by industry and year										
Agriculture forestry animal husbandry and fisheries	2	4	13	2	1	0	1	2	3	28
Mining	3	13	4	8	0	1	5	4	2	40
Manufacturing	46	85	232	102	95	78	104	97	158	997
Electric power, heat, gas, and water production and supply	7	3	8	5	3	5	8	5	6	50
Construction	1	1	7	14	1	6	4	9	2	45

Wholesale and retail	2	5	9	8	8	0	2	14	6	54
Transport post and telecommunication services	0	5	2	4	2	2	6	0	5	26
Accommodation and catering industry	0	0	0	0	0	1	0	0	0	1
Information transfer computer services and software	2	7	35	21	12	11	4	17	16	125
Real estate	4	3	7	1	1	4	3	2	4	29
Leasing and commercial services	3	2	7	0	1	1	1	1	8	24
Scientific research polytechnic services and geological prospecting	0	2	1	9	0	1	2	5	7	27
Administration of water environment and public facilities	1	3	4	1	0	0	0	1	1	11
Industry of resident service, repair, and other services	1	0	0	0	0	0	0	0	0	1
Education	0	0	1	0	0	0	0	0	1	2
Health care social insurance / welfare	0	0	0	0	0	2	0	0	0	2
Culture sports and entertainment	1	5	8	5	1	1	1	1	1	24
Diversified industries	0	0	1	0	1	1	0	0	0	3
Panel B: Sample distribution by ESG level and year										
AAA (Value=9)	0	0	4	0	7	0	6	5	7	29
AA (Value=8)	12	25	78	39	19	23	23	19	23	261

A (Value=7)	9	20	54	43	38	27	34	34	53	312
BBB (Value=6)	52	85	186	86	56	49	59	75	116	764
BB (Value=5)	0	6	13	10	5	11	15	16	12	88
B (Value=4)	0	2	1	2	0	4	4	9	4	26
CCC (Value=3)	0	0	3	0	1	0	0	0	5	9

Table 4.2 presents the summary statistics for my acquirers across the full sample and subsamples classified according to the sample median of the ESG score. In the full sample, the average acquiring firm has an ESG rating of 6. Approximately 17.9% of the acquirers experienced an ESG upgrade and 10.6% experienced an ESG downgrade prior to the bid. The average acquirer total asset is 6823.563 million yuan, while the average deal value is 473.704 million yuan. Most of the deals are classified as diversification deals (85.4%) and most are paid by cash (71.6%).

Table 4.2 Descriptive statistics

The table presents descriptive statistics for a sample of 1,489 completed Chinese domestic M&A deals between 2011 and 2019. It describes the mean and median of observations for bidder- and deal-specific characteristics, respectively, both for the whole sample as well as for high-ESG and low-ESG acquirers. All variables are defined in Appendix A. Statistical tests for differences in means and equality of medians for each characteristic for high ESG versus low ESG are also presented. All continued variables are winsorised at the 1st and 99th percentiles.

	Full sample		Subsample of high-ESG acquirers (ESG score>6): A		Subsample of low-ESG acquirers (ESG score<=6): B		Test of difference (A-B)	
	n=1489		n=602		n=887			
Variable	Mean	Median	Mean	Median	Mean	Median	Mean	Median
ESG level	6.506	6						
ESG upgrade	0.179	0						
ESG downgrade	0.106	0						
Acquirer total asset (millions of yuan)	6823.563	2502.558	11000	3347.109	3834.486	2081.502	7165.514 ***	44.555***

Acquirer Tobin's Q	2.098	1.676	2.002	1.633	2.163	1.688	-0.161*	0.712
Acquirer cash	0.21	0.171	0.216	0.184	0.205	0.161	0.011	4.552**
Acquirer leverage	0.377	0.353	0.398	0.391	0.362	0.333	0.036***	10.173***
Acquirer SOE	0.291	0	0.422	0.000	0.202	0	0.22***	84.255***
Deal value (millions of yuan)	473.704	114.750	600.827	161.075	387.426	100.600	213.401***	9.777***
allstock	0.152	0	0.169	0.000	0.140	0	0.029	0.477
diversify	0.854	1	0.846	1.000	0.859	1	-0.013	0
allcash	0.716	1	0.683	1.000	0.738	1	-0.055**	0

In terms of the subsample difference, several features are worth noting. Firms with high ESG scores are significantly bigger and have greater leverage. As for deal characteristics, I find that compared with firms with low ESG scores, firms with high ESG scores prefer to acquire bigger targets and are less likely to pay with cash. The correlation matrix of the above variables is presented in Table 4.3.

Table 4.3 Correlation matrix

The table presents pairwise correlations of the variables. The sample consists of 1,489 completed Chinese domestic M&A deals between 2011 and 2019. All variables are defined in Appendix A. All continued variables are winsorised at the 1st and 99th percentiles.

Panel B: Correlation matrix

	ESG level	Up. ESG	Down. ESG	Acq. Size	Acq. Tobin's Q	Acq. cash	Acq. leverage	Acq. SOE	Deal size	allstock	diversify	allcash
ESG level	1.000											
Upgrade ESG	0.265	1.000										
Downgrade ESG	-0.412	-0.161	1.000									
Acquirer size (in(total asset))	0.325	0.021	-0.060	1.000								
Acquirer Tobin's Q	-0.091	-0.039	0.077	-0.382	1.000							
Acquirer cash	0.008	-0.014	-0.033	-0.272	0.130	1.000						

Acquirer												
leverage	0.087	-0.028	-0.016	0.488	-0.150	-0.418	1.000					
Acquirer SOE	0.118	0.029	-0.025	0.275	-0.064	-0.145	0.196	1.000				
Deal size	0.042	0.032	-0.012	-0.019	0.035	-0.037	0.139	0.261	1.000			
allstock	0.279	0.053	-0.125	0.352	-0.125	-0.108	0.354	0.217	0.236	1.000		
diversify	-0.014	0.074	-0.018	0.005	0.043	-0.046	-0.061	0.081	0.043	-0.070	1.000	
allcash	-0.038	-0.079	0.019	0.128	0.016	-0.081	-0.060	-0.413	-0.671	-0.190	-0.021	1.000

4.4.3 Methodology

ESG and post-M&A performance

I apply both univariate and multi-variate analysis in order to explore the association between corporate ESG level and post-M&A performance. In terms of the multivariate analysis, I perform a cross-sectional regression by estimating the following equation:

$$Acquirer's\ performance_{it} = \beta_0 + \beta_1 ESG\ rating_{it-1} + \beta_k \sum acquirer\ Controls_{it-1} + \beta_k \sum Deal\ Controls_{it} + \gamma + \vartheta + \epsilon_{it} \quad (3)$$

where $Acquirer's\ performance_{it}$ represents the acquirers' one-year-forward BHARs, ROA, and ROE of deal *i* in year *t*. The main dependent variable is the acquirer's ESG rating at the end of year *t-1*. In addition to including the control variables discussed in Section 4.4.1 in the regressions, I control for industry and year fixed effects.

Dynamics of ESG and post-M&A performance

To explore the impact of acquirers' ESG rating dynamics on post-M&A performance and to test the initial ESG dependent view, I divide my full sample by acquirers' initial ESG performance. Initial ESG performance is proxied by the acquirer's ESG rating at the end of two years prior to the bid (t-2) to better capture the variation of ESG rating one year prior to the deal announcement. I split acquirers into high-initial-ESG and low-initial-ESG acquirers by the sample median (6) of ESG rating. Acquirers with an ESG rating higher than 6 at the end of two years prior to the deal announcement are classified into the high-initial-ESG-acquirer sample

while acquirers with an ESG rating equal to or lower than 6 at the end of two years prior to the deal announcement are classified into the low-initial-ESG-acquirer sample.[22]

For each sample, I regress the one-year forward stock market performance and operational performance on the upgrade and downgrade of ESG rating:

$$Acquirer's\ performance_{it} = \beta_0 + \beta_1 ESG\ upgrade_{it-2,t-1} + \beta_2 ESG\ downgrade_{it-2,t-1} + \beta_k \sum acquirer\ Controls_{it-1} + \beta_k \sum Deal\ Controls_{it} + \gamma + \vartheta + \epsilon_{it} \quad (4)$$

where $Acquirer's\ performance_{it}$ is the same as in Section 4.4.1, $ESG\ upgrade_{it-2,t-1}$ is a dummy variable indicating the acquirer's ESG rating upgrade from yar t-2 to t-1, and $ESG\ downgrade_{it-2,t-1}$ is a dummy variable indicating the acquirer's ESG rating downgrade from yar t-2 to t-1. Control variables are the same as in Eq. (3).

4.5 Results

In this section, I provide results regarding ESG ratings and their relationship with one-year post-M&A stock returns and one-year post-M&A operating performance.

4.5.1 ESG rating and post-M&A performance

Univariate analysis

In this section, I test my first hypothesis regarding the effect of corporate ESG performance on post-M&A performance. I carry out a univariate analysis for my post-M&A performance

[22] This classification criterion is also in accordance with the guidelines of the SSI ESG database, which identifies firms with an ESG rating equal to or higher than A (6) as 'Leader' and others as 'Average' or 'Laggard'. Detailed information on this can be found at https://www.chindices.com/service.html.

measurements, including one-year BHAR, post-one-year ROA, and post-one-year ROE of acquirers.

Table 4.4 provides the mean and median of the post-M&A performance measurement based on acquirers' ESG performance at the end of the year prior to the M&A. Acquirers are divided into high-ESG acquirers if their rating is higher than 6, which is the sample median ESG rating, and are classified as ESG rating leaders by the data provider. The empirical results show that acquirers with a high level of ESG performance are inclined to have higher one-year-forward stock returns (0.14) than do low-ESG acquirers (0.038). Furthermore, when I look at the measurements of post-M&A operation performance, the results show that acquirers with a high level of ESG performance appear to have higher one-year-forward ROA and ROE, implying that stakeholders contribute to operational activity after M&A.

Table 4.4 Univariate analysis

The sample consists of 1,489 completed Chinese domestic M&A deals between 2011 and 2019. The initial sample of mergers comes from the China Stock Market & Accounting Research (CSMAR) database. My final sample includes all completed domestic M&As that meet the following five selection criteria: (1) the deal value disclosed is greater than ¥5 million yuan; (2) the targets of the deal are not plant or the right to use land; (3) the deal is completed by the end of 2019; (4) the acquirer is publicly traded and has stock return and financial data available from the CSMAR; (5) the acquirer is on the SSI ESG rating database; and (6) neither the acquirer nor the target is in the financial industries as classified by the China Securities Regulatory Commission (CSRC). Acquirers are divided into high and low corporate ESG firms according to the sample median of ESG level. BHAR_1year is the acquirer's BHARs calculated by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of acquirers over the one-year period after the M&A announcement date. ROA_1year is the acquirer's return on asset (ROA) over the one-year period after the M&A announcement date. ROE_1year is the acquirer's return on equity (ROE) over the one-year period after the M&A announcement date. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

	Full sample n=1489		Subsample of high-ESG acquirers (ESG score>6): A n=602		Subsample of low-ESG acquirers (ESG score<=6): B n=887		Test of difference: A-B	
Variable	Mean	Mdn	Mean	Mdn	Mean	Mdn	Mean	Mdn
BHAR_1year	0.079	-0.024	0.14	-0.005	0.038	-0.04	0.102***	2.065

ROA_1year	0.039	0.043	0.044	0.042	0.035	0.043	0.009*	0.215
ROE_1year	0.077	0.082	0.088	0.089	0.07	0.078	0.018***	8.254***

Cross-sectional regression analysis:

Given that the univariate examination may struggle to address a number of confusing issues, I perform a cross-sectional regression to further analyse the association between corporate ESG level and post-M&A performance.

The results are reported in Table 4.5. Column (1) indicates that the coefficient of the variable $ESG\ rating_{it-1}$ is positive and significant at the 5% level, and an increase of one score in ESG performance elicits an increase of 3.6% in the acquiring firm's one-year-forward buy-and-hold return. In terms of economic significance, the estimated coefficient suggests that one standard deviation increase in the acquirer's ESG level increases the average one-year stock performance by 5.8%.[23] Considering that the average BHARs for acquirers in my sample is 7.9%, this increase is economically significant. Indeed, it suggests that investors favour acquirers with a high level of ESG performance, which is in line with my univariate findings.

Table 4.5 ESG level and post-M&A performance

This table presents regression estimates of one-year post-M&A stock and operational performance on the ESG level and control variables across the full sample. Column (1) uses one-year-forward BHARs, which is calculated by subtracting the buy-and-hold return of reference portfolio from buy-and-hold return of acquirers over the one-year period after the M&A announcement date. Column (2) uses ROA_1year, which is the acquirer's return on asset (ROA) over the one-year period after the M&A announcement date. Column (3) uses ROE_1year, which is the acquirer's return on equity (ROE) over the one-year period after the M&A announcement date. The main independent variable throughout the columns is ESG level,

[23] The standard deviations (unreported) of BHAR and ESG level are 0.624 and 1.007, respectively. I compute 5.8%: [(0.036× 1.007)/0.624] × 100.

which equals 1 if the SSI ESG rating is C, 2 if the rating is CC, 3 if the rating is CCC, 4 if the rating is B, 5 if the rating is BB, 6 if the rating is BBB, 7 if the rating is A, 8 if the rating is AA, and 9 if the rating is AAA. The control variables include the following: Acquirer size, which is the natural logarithm of the acquirer's book value of asset; Acquirer Tobin's Q, which is the market value of the acquirer's equity divided by total assets; Acquirer cash, which is the acquirer's ratio of corporate cash to total asset; Acquirer leverage, which is the acquirer's ratio of total debt to total asset; Acquirer SOE, which is a dummy variable that takes the value of one when the ultimate controller is the state or government; Deal size, which is the natural logarithm of the expense value of the deal; an all stock dummy, which indicates that the form of payment is stock-only; a diversify dummy variable, which takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise; and an all cash dummy, which takes the value of one when the form of payment is cash-only, and zero otherwise. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	BHAR_1year	ROA_1year	ROE_1year
	(1)	(2)	(3)
ESG level	0.036**	0.009***	0.011***
	(1.98)	(3.13)	(2.82)
Acquirer size	-0.047**	0.004	0.011**
	(-2.19)	(1.28)	(2.32)
Acquirer Tobin's Q	-0.014	0.008***	0.015***
	(-0.84)	(3.24)	(4.29)
Acquirer cash	0.147	0.097***	0.095***
	(1.04)	(4.44)	(3.18)
Acquirer leverage	0.059	0.025	0.047*
	(0.51)	(1.41)	(1.93)

SOE	-0.009	-0.012*	-0.021**
	(-0.20)	(-1.75)	(-2.14)
Deal size	-0.009	-0.000	0.002
	(-0.74)	(-0.01)	(0.93)
allstock	0.252***	0.002	0.003
	(3.95)	(0.16)	(0.21)
diversify	0.008	-0.011	-0.024**
	(0.17)	(-1.50)	(-2.35)
allcash	0.027	-0.011	-0.018
	(0.47)	(-1.22)	(-1.46)
Constant	0.946**	-0.117*	-0.291***
	(2.09)	(-1.70)	(-2.75)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	1,489	1,489	1,489
R-squared	0.121	0.107	0.115

Columns (2) and (3) of Table 4.5 indicate that the acquirer's ESG performance positively impacts its one-year post-M&A operational performance. In economic terms, one standard deviation increase in the acquirer's ESG level increases the average one-year operational performance by 9.4% as measured by ROA (and 6.8% as measured by ROE).[24] Considering that the average one-year post-M&A ROA and ROE for acquirers in my sample is 3.9% and 7.7%, respectively, this increase is economically significant. I find that firms with a high level of ESG performance realise higher long-term post-M&A ROA and ROE.

Overall, the results shown in Table 4.5 confirm the univariate results reported in Table 4.3. These results indicate that for acquiring firms, the higher the ESG performance, the better the post-M&A performance is, which supports the instrumental stakeholder theory.

4.5.2 Dynamics of ESG and post-M&A performance:

Prior results demonstrate that acquirers' ESG performance level is positively related to post-M&A performance. I next explore the impact of acquirers' ESG rating dynamics on post-M&A performance and test the initial ESG dependent view. Initial ESG performance is proxied by the acquirer's ESG rating at the end of two years prior to the bid (t-2) to better capture the variation in ESG rating one year prior to the deal announcement. I divide the samples into high-initial-ESG and low-initial-ESG acquirers using the sample median (6) for ESG rating. Acquirers with an ESG rating higher than 6 at the end of two years prior to the deal announcement are classified into the high-initial-ESG-acquirer sample while acquirers with an ESG rating equal to or lower than 6 at the end of two years prior to the deal announcement are classified into the low-initial-ESG-acquirer sample.

[24] The standard deviations (unreported) of ROA and ROE are 0.0959 and 0.1319, respectively. I compute 9.4% [(0.009× 1.007)/0.0959] × 100 and 6.8% [(0.009× 1.007)/0.1319] × 100.

Panel A of Table 4.6 provides the results for the acquirers with a high initial ESG rating. Column (1) indicates a negative and statistically significant relationship between ESG downgrade and one-year-forward BHARs, whereas there is an insignificant relationship between ESG upgrade and one-year-forward BHARs. Furthermore, columns (2) and (3) show a similar relationship between ESG change and post-M&A ROA and ROE. These empirical findings support my conjecture that ESG downgrade is negatively related to post-M&A performance for acquirers with a high initial ESG performance level.

Table 4.6 ESG dynamics and post-M&A performance

This table presents regression estimates of one-year post-M&A stock and operational performance on ESG level and control variables. I divide full sample into two subsamples by the median of the initial ESG level, which is the ESG level at the end of two years prior to the M&A. I conduct my regressions with high-initial-ESG acquirers in Panel A, while I conduct my regressions with low-ESG acquirers in Panel B. In both panels, column (1) uses one-year forward BHARs, which is calculated by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of the acquirer over the one-year period after the M&A announcement date. Column (2) uses ROA_1year, which is the acquirer's return on asset (ROA) over the one-year period after the M&A announcement date. Column (3) uses ROE_1year, which is the acquirer's return on equity (ROE) over the one-year period after the M&A announcement date. The main independent variables throughout the columns are ESG upgrade, a dummy variable that takes the value of one if the acquirer has an ESG rating upgrade one year prior to the M&A deal, and zero otherwise, and ESG downgrade, a dummy variable that takes the value of one if the acquirer has an ESG rating downgrade one year prior to the M&A deal, and zero otherwise. The control variables include the following: Acquirer size, which is the natural logarithm of the acquirer's book value of asset; Acquirer Tobin's Q, which is the market value of the acquirer's equity divided by total assets; Acquirer cash, which is the acquirer's ratio of corporate cash to total asset; Acquirer leverage, which is the acquirer's ratio of total debt to total asset; Acquirer SOE, which is a dummy variable that takes the value of one when the ultimate controller is the state or government; Deals size, which is the natural logarithm of the expense value of the deal; an all stock dummy indicating that the form of payment is stock-only; a diversify dummy variable that takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise; and an all cash dummy that takes the value of one when the form of payment is cash-only, and

zero otherwise. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Subsample of high existing ESG				Panel B: Subsample of low existing ESG		
Variables	BHAR_1year	ROA_1year	ROE_1year	BHAR_1year	ROA_1year	ROE_1year
	(1)	(2)	(3)	(1)	(2)	(3)
ESG upgrade	-0.021	-0.002	-0.021	0.088***	0.052**	0.011**
	(-0.10)	(-0.18)	(-0.76)	(2.72)	(1.98)	(2.12)
ESG downgrade	-0.259**	-0.025***	-0.045***	0.061	-0.003	-0.002
	(-2.16)	(-3.24)	(-2.87)	(1.09)	(-0.17)	(-0.10)
Acquirer size	0.013	0.012***	0.026***	-0.064***	0.004	0.012*
	(0.23)	(3.27)	(3.67)	(-3.37)	(0.74)	(1.93)
Acquirer Tobin's Q	0.004	0.011***	0.017***	-0.030**	0.005	0.014***
	(0.11)	(4.33)	(3.24)	(-2.04)	(1.37)	(2.76)
Acquirer cash	0.858**	0.020	0.034	0.014	0.137***	0.124***
	(2.18)	(0.77)	(0.67)	(0.13)	(4.43)	(3.24)
Acquirer leverage	-0.504	-0.057***	-0.022	0.187**	0.052**	0.051

	(-1.52)	(-2.62)	(-0.52)	(2.02)	(2.06)	(1.65)
SOE	-0.161	-0.011	-0.021	-0.001	-0.005	-0.016
	(-1.31)	(-1.41)	(-1.30)	(-0.04)	(-0.52)	(-1.27)
Deal size	-0.027	-0.001	0.000	-0.006	-0.001	0.001
	(-0.85)	(-0.51)	(0.10)	(-0.65)	(-0.41)	(0.18)
allstock	0.576***	0.008	0.024	0.078	-0.001	0.002
	(3.24)	(0.70)	(1.05)	(1.49)	(-0.04)	(0.12)
diversify	0.032	-0.009	-0.016	-0.018	-0.014	-0.029**
	(0.26)	(-1.09)	(-0.98)	(-0.45)	(-1.33)	(-2.20)
allcash	-0.039	-0.002	0.006	0.017	-0.016	-0.025
	(-0.24)	(-0.22)	(0.27)	(0.36)	(-1.25)	(-1.54)
Constant	0.394	-0.185**	-0.512***	1.516***	-0.057	-0.23
	(0.34)	(-2.46)	(-3.42)	(-3.51)	(-0.49)	(-1.58)
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	510	510	510	979	979	979

R-squared	0.213	0.328	0.316	0.160	0.126	0.129

Panel B of Table 4.6 presents the results for the acquirers with a low initial ESG rating. From column (1) through column (3), the empirical results indicate a mirror image of the results for the high-initial-ESG-rating sample. Acquirers with low initial ESG performance will have higher post-M&A performance.

Jointly, I can conclude that, consistent with the prediction of the law of diminishing utility of stakeholders, the effect of acquirers' ESG dynamics on post-M&A performance is asymmetric and dependent on the initial ESG achievement.

4.6 Robustness checks and further investigation

In this section, I briefly summarise the results of additional tests in order to check the robustness of my results and to further analyse the possibility of value-enhancing deals and deal completion.

4.6.1 Robustness tests

Industry effect

To ensure that my results are not driven by a specific industry classification used in our analysis, I conduct additional analyses. First, previous studies show that mergers occur in waves and strongly cluster by industry (Mitchell & Mulherin 1996; Harford 2005). Therefore, if high ESG firms are clustered in specific industries that are systematically different from industries in which low ESG firms are clustered, our industry control based on CSRC classification in 2012 might not be sufficient. To alleviate the concern that mergers cluster by industry, I experiment with an alternative industry classification based on CSRC classification in 2001. I find that the results in Tables 4.4 and 4.5 do not change when I use alternative classification in industry control.

Alternative measure of ESG rating

To reflect that the difference between categories (i.e. A vs. B, and C ratings) may be greater than the gap within groups, I reassign my ESG level measurement. Specifically, I create ESG level (ESG level 2) such that the new variable equals 1 if the ESG rating is C, 2 if the ESG rating is CC, 3 if the ESG rating is CCC, 5 if the ESG rating is B, 6 if the ESG rating is BB ,7 if the ESG rating is BB, 9 if the ESG rating is A, 10 if the ESG rating is AA, and 11 if the ESG rating is AAA. I then reconduct Eq. 3 with the new variable. The results are presented in Table 4.7. I find that the results in Table 4.4 do not change when I use alternative ESG level measurement.

Table 4.7 Robustness check: Alternative value to ESG rating

In this table I reconduct Eq. 3 with an alternative value of ESG rating – ESG level 2 for the full sample. Column (1) uses one-year forward BHARs, which is calculated by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of the acquirer over the one-year period after the M&A announcement date. Column (2) uses ROA_1year, which is the acquirer's return on asset (ROA) over the one-year period after the M&A announcement date. Column (3) uses ROE_1year, which is the acquirer's return on equity (ROE) over the one- year period after the M&A announcement date. The main independent variables are as follows: the ESG rating level 2 equals 1 if the SSI ESG rating is C, 2 if the rating is CC, 3 if the rating is CCC, 5 if the rating is B, 6 if the rating is BB, 7 if the rating is BBB, 9 if the rating is A, 10 if the rating is AA, and 11 if the rating is AAA. Control variables include the following: Acquirer size, which is the natural logarithm of the acquirer's book value of asset; Acquirer Tobin's Q, which is the market value of the acquirer's equity divided by total assets; Acquirer cash, which is the acquirer's ratio of corporate cash to total asset; Acquirer cash, which is the acquirer's ratio of total debt to total asset; Acquirer SOE, which is a dummy variable that takes the value of one when the ultimate controller is the state or government; Deal size, which is the natural logarithm of the expense value of the deal; an all stock dummy indicating that the form of

payment is stock-only; a diversify dummy variable that takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise; and an all cash dummy that takes the value of one when the form of payment is cash-only, and zero otherwise. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	BHAR_12m	ROA_1year	ROE_1year
	(1)	(2)	(3)
ESG level 2	0.029**	0.005***	0.007***
	(2.30)	(2.79)	(2.63)
Acquirer size	-0.048**	0.005	0.011**
	(-2.27)	(1.41)	(2.42)
Acquirer Tobin's Q	-0.014	0.008***	0.015***
	(-0.86)	(3.25)	(4.29)
Acquirer cash	0.141	0.096***	0.094***
	(1.00)	(4.38)	(3.13)
Acquirer leverage	0.059	0.024	0.046*
	(0.51)	(1.32)	(1.87)
SOE	-0.011	-0.012*	-0.020**
	(-0.25)	(-1.68)	(-2.10)
Deal size	-0.009	0.000	0.002
	(-0.73)	(0.00)	(0.94)
allstock	0.252***	0.001	0.003
	(3.95)	(0.15)	(0.20)
diversify	0.008	-0.011	-0.024**
	(0.17)	(-1.51)	(-2.36)
allcash	0.029	-0.011	-0.018

	(0.50)	(-1.19)	(-1.44)
Constant	0.983**	-0.132*	-0.292***
	(2.17)	(-1.88)	(-3.04)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	1,489	1,489	1,489
R-squared	0.122	0.107	0.114

More controls

Another potential concern would be that of ESG being a proxy for other known factors that affect merger performance. For example, firms could invest in ESG activities as a result of pressure from activist shareholders, in which case the positive relation between the ESG measure and M&A performance could simply reflect the value-enhancing role of blockholders in M&A (Chen *et al.* 2007 2007). To address this concern, I control for various measures of an acquirer's ownership concentration in regressions (3) and (4). In particular, I include controls that measure the extent of the acquiring firm's institutional investor portion, the individual investor's portion, and the blockholder indicator (which takes the value of one if at least one investor holds more than 5% of the firm's outstanding shares and zero otherwise). The results are presented in Table 4.8. I find that the coefficient estimates on ESG and the dynamics of ESG remain significant.

Table 4.8 Robustness: More controls

In this table I reconduct Eq 3. and Eq. 4 with more controls. In Panel A, I reconduct Eq. 3 with more controls for the full sample. In Panel B, I conduct Eq. 4 in subsamples of high-initial-ESG acquirers. In Panel C, I conduct Eq. 4 in subsamples of low-ESG-rating acquirers. In all panels, column (1) uses one-year forward BHARs, which is calculated by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of the acquirer over the one-year period after the M&A announcement date; column (2) uses ROA_1year, which is the acquirer's return on asset (ROA) over the one-year period after the M&A announcement date; column (3) uses ROE_1year, which is the acquirer's return on equity (ROE) over the one-year period after the M&A announcement date. The main independent variables include the following: (1) ESG level, which equals 1 if the SSI ESG rating is C, 2 if the rating is CC, 3 if the rating is CCC, 4 if the rating is B, 5 if the rating is BB, 6 if the rating is BBB, 7 if the rating is A, 8 if the rating is AA, and 9 if the rating is AAA in Panel A; (2)bESG upgrade, a dummy variable that takes the value of one if the acquirer undergoes an ESG rating upgrade one year prior to the M&A deal, and zero otherwise; and (3) ESG downgrade, a dummy variable that takes the value of one if the acquirer undergoes an ESG rating downgrade one year prior to the M&A deal, and zero otherwise. The control variables are as follows: Acquirer size, which is the natural logarithm of the acquirer's book value of asset; Acquirer Tobin's Q, which is the market value of the acquirer's equity divided by total assets; Acquirer cash, which is the acquirer's ratio of corporate cash to total asset; Acquirer leverage, which is the acquirer's ratio of total debt to total asset; Acquirer SOE, which is a dummy variable that takes the value of one when the ultimate controller is the state or government; Deal size, which is the natural logarithm of the expense value of the deal; an all stock dummy indicating that the form of payment is stock-only; a diversify dummy variable that takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise; and an all cash dummy that takes the value of one when the form of payment is cash-only, and zero otherwise. The extended control

variables include Institutional investor, which is the percentage of shares held by institutional investors to total shares; BIND, which is the percentage of independent members on a board, and Blockholder, a dummy variable that takes the value of one if at least one investor holds more than 5% of the firm's outstanding shares and zero otherwise. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Full sample				Panel B: Subsample of high existing ESG			Panel C: Subsample of low existing ESG		
Variables	BHAR_1year	ROA_1year	ROE_1year	BHAR_1year	ROA_1year	ROE_1year	BHAR_1year	ROA_1year	ROE_1year
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ESG level	0.038**	0.009***	0.011***						
	(2.05)	(3.09)	(2.72)						
ESG upgrade				-0.017	-0.002	-0.020	0.087***	0.051**	0.010**
				(-0.08)	(-0.17)	(-0.73)	(2.70)	(1.97)	(2.10)
ESG downgrade				-0.262**	-0.025***	-0.043***	0.059	-0.002	-0.000
				(-2.16)	(-3.15)	(-2.77)	(1.05)	(-0.14)	(-0.02)

Acquirer size	-0.042*	0.004	0.009**	0.017	0.011***	0.024***	-0.056***	0.005	0.012*
	(-1.86)	(1.24)	(1.97)	(0.29)	(2.93)	(3.21)	(-2.80)	(0.90)	(1.84)
Acquirer Tobin's Q	-0.014	0.009***	0.015***	0.005	0.012***	0.017***	-0.028*	0.006	0.014***
	(-0.85)	(3.38)	(4.26)	(0.11)	(4.23)	(3.11)	(-1.89)	(1.54)	(2.85)
Acquirer cash	0.162	0.096***	0.093***	0.865**	0.018	0.031	0.030	0.134***	0.118***
	(1.14)	(4.39)	(3.11)	(2.18)	(0.71)	(0.61)	(0.26)	(4.31)	(3.07)
Acquirer leverage	0.056	0.026	0.049**	-0.502	-0.058***	-0.027	0.188**	0.049*	0.050
	(0.48)	(1.48)	(2.02)	(-1.48)	(-2.62)	(-0.62)	(2.02)	(1.94)	(1.58)
SOE	0.002	-0.011	-0.023**	-0.148	-0.015*	-0.030*	0.009	-0.003	-0.015
	(0.05)	(-1.49)	(-2.24)	(-1.13)	(-1.80)	(-1.79)	(0.23)	(-0.26)	(-1.15)
Deal size	-0.009	0.000	0.002	-0.027	-0.001	0.001	-0.007	-0.001	0.001
	(-0.77)	(0.05)	(0.96)	(-0.86)	(-0.42)	(0.18)	(-0.69)	(-0.27)	(0.27)
allstock	0.251***	-0.000	0.002	0.570***	0.010	0.028	0.074	-0.002	0.000
	(3.91)	(-0.03)	(0.12)	(3.18)	(0.83)	(1.22)	(1.41)	(-0.16)	(0.02)
diversify	0.005	-0.010	-0.023**	0.032	-0.008	-0.015	-0.023	-0.014	-0.028**

	(0.10)	(-1.38)	(-2.24)	(0.26)	(-1.03)	(-0.94)	(-0.59)	(-1.28)	(-2.14)
allcash	0.031	-0.013	-0.020	-0.042	-0.001	0.009	0.023	-0.017	-0.027*
	(0.53)	(-1.40)	(-1.59)	(-0.26)	(-0.10)	(0.41)	(0.48)	(-1.34)	(-1.66)
Institutional investor	-0.000	-0.000	0.000	-0.000	0.000	0.000	-0.001	-0.000	-0.000
	(-0.23)	(-0.91)	(0.06)	(-0.18)	(0.46)	(0.84)	(-0.88)	(-1.05)	(-0.77)
BIND	0.057	0.043	0.011	0.064	-0.039	-0.086	-0.140	0.019	-0.015
	(0.25)	(1.22)	(0.22)	(0.11)	(-1.00)	(-1.12)	(-0.72)	(0.36)	(-0.22)
Blockholder	-0.001	0.000**	0.000*	-0.001	0.000	0.000	-0.001	0.000	0.001**
	(-1.10)	(2.06)	(1.77)	(-0.17)	(0.80)	(0.65)	(-1.09)	(1.63)	(2.03)
Constant	0.866*	-0.169**	-0.296***	0.323	-0.172**	-0.469***	1.456***	-0.104	-0.247
	(1.81)	(-2.28)	(-2.92)	(0.26)	(-2.18)	(-2.97)	(3.15)	(-0.82)	(-1.58)
Observations	1,489	1,489	1,489	510	510	510	979	979	979
R-squared	0.122	0.112	0.117	0.214	0.334	0.321	0.163	0.129	0.133
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

4.6.2 Endogeneity problems

Although the use of multiple control variables lagged by a year could mitigate the omitted variables bias and reverse causality concerns, the regression results may still suffer from endogeneity issues caused by unobservable omitted variables. To address such endogeneity problems, we estimate instrumental variable regressions (two-stage-least-squares or 2SLS). In the first stage, we estimate ordinary least square regressions to predict the value of acquirers' ESG level. In particular, we regress our ESG measure on explanatory variables of acquirers used in Eq. 3 and on two instrumental variables. For the choice of instruments, we base our work on Ioannou and Serafeim (2012) who show that ESG is determined by both location (i.e., province) and industry characteristics. More precisely, a firm's ESG is impacted by the ESG level of other firms within the same industry-location pair and by the ESG of other firms in the same province over time. We follow Cheng *et al.* (2014), Arouri and Pijourlet (2017), Gomes and Marsat (2018), and Arouri *et al.* (2019) in adopting the province-year ESG median rating and the province-industry ESG median rating as instruments. To further substantiate our instrument selection, we conduct two tests in each 2SLS regression: (1) a Cragg and Donald (1993) instrument relevance test to ensure the instruments' relevance (i.e., high correlations between the instruments and adjusted ESG), and (2) a Sargan (1958) overidentification test to investigate the instruments' exogeneity (i.e., no significant correlation between the instruments and the residuals in the arbitrage spread regressions). Results are presented in Table 4.9.

Table 4.9 Instrumental variables estimations

In this table, we present our two-stage least square estimations. In the first stage, ESG scores (overall, environment, social, and governance) are regressed on the instrument-province-industry median of ESG level and instrument-province-year median of ESG level. Predicted_ESG level is the predicted value of the overall ESG level. Dependent variables in

Column (2), (3), and (4) are one-year forward BHARs which are calculated by subtracting buy-and-hold return of reference portfolio from buy-and-hold return of acquirers over the one-year period after the M&A announcement date; ROA_1year ,which is the acquirers' return on asset (ROA) over the one-year period after the M&A announcement date; and ROE_1year, which is the acquirers' return on equity (ROE) over the one-year period after the M&A announcement date, respectively. The control variables are as follows: Acquirer size, which is the natural logarithm of the acquirer's book value of asset; Acquirer Tobin's Q, which is the market value of the acquirer's equity divided by total assets; Acquirer cash, which is the acquirer's ratio of corporate cash to total asset; Acquirer leverage, which is the acquirer's ratio of total debt to total asset; Acquirer SOE, which is a dummy variable that takes the value of one when the ultimate controller is the state or government; Deal size, which is the natural logarithm of the expense value of the deal; an all stock dummy indicating that the form of payment is stock-only; a diversify dummy variable that takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise; an all cash dummy that takes the value of one when the form of payment is cash-only, and zero otherwise. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	First stage	Second stage		
VARIABLES	ESG Level	BHAR_1year	ROA_1year	ROE_1year
	(1)	(2)	(3)	(4)
Predicted ESG level		0.076**	0.011**	0.019*
		(2.00)	(1.97)	(1.67)
Instrumental variable				
Province-industry ESG	0.452***			
	(8.49)			

Province-year ESG	0.432***			
	(4.04)			
Acquirer Size	0.311***	-0.079***	-0.002	0.002
	(9.55)	(-4.13)	(-0.59)	(0.38)
Acquirer TobinQ	0.020	-0.026**	0.003***	0.005**
	(0.89)	(-2.55)	(3.01)	(2.55)
Acquirer Cash	-0.073	-0.011	0.081***	0.109**
	(-0.37)	(-0.13)	(3.62)	(2.33)
Acquirer Leverage	-0.635***	0.236***	0.004	0.067
	(-4.01)	(3.14)	(0.16)	(1.52)
SOE	0.408***	0.004	-0.014**	-0.021**
	(6.45)	(0.12)	(-2.55)	(-2.00)
Deal Size	0.006	-0.004	0.002	0.004
	(0.38)	(-0.60)	(1.33)	(1.54)
Allstock	-0.031	0.064	0.005	0.010
	(-0.35)	(1.64)	(0.70)	(0.84)
Diversify	-0.065	-0.021	-0.010**	-0.020**
	(-0.98)	(-0.71)	(-2.12)	(-2.22)
Allcash	-0.008	-0.013	-0.010*	-0.018
	(-0.09)	(-0.35)	(-1.68)	(-1.62)
Constant	-7.028***	1.310***	0.007	-0.160
	(-7.33)	(3.85)	(0.10)	(-1.24)
First stage Cragg and Donald test	(P-value<0.001)			

Overidentification test		(P-Value=0.84)	(P-Value=0.11)	(P-Value=0.11)
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	1,489	1,489	1,489	1,489
R-squared	0.338	0.156	0.155	0.111

In the first-stage regressions reported in column (1), I see that my instrument is statistically significant, which seems to validate their use. In the second-stage regressions, I substitute the predicted values of my ESG measures for the actual ESG scores and report results in columns (2), (3), and (4). These results confirm my previous findings in that the predicted values of my ESG measures are positively associated with the acquirer's post-M&A BHARs, ROA, and ROE at the usual significance levels.

4.6.3 Additional investigation

ESG and likelihood of deal completion

According to the instrumental stakeholder view, M&A announced by high- ESG acquirers have a greater likelihood of being completed. In this section, I provide additional analysis of this prediction by using a sample of 1,794 successful and unsuccessful Chinese domestic M&As.

Table 4.11 presents the results of a probit regression in which the dependent variable is a dummy variable that equals one if the deal is completed and zero otherwise. In column (1), the regression results show that the probability of deal completion increases in line with an acquirer's ESG score. Column (2) displays the results for high-initial-ESG acquirers while the

results for low-initial-ESG acquirers are shown in column (3). I find that the coefficient of ESG downgrade is significantly negative for the high-initial-ESG sample and the coefficient of ESG upgrade is significantly positive for the low-initial-ESG sample. Clearly, high ESG level for all acquirers and ESG upgrade for low-initial-ESG acquirers lead to a significantly higher probability of deal completion. These results are consistent with the instrumental stakeholder view and the law of diminishing marginal utility.

Table 4.10 Likelihood of deal completion

In this table, I analyse the likelihood of deal completion. In column (1), I use ESG level as an independent variable across the full sample. In columns (2) and (3) I use ESG upgrade and ESG downgrade as independent variables for the high-initial-ESG acquirers' sample and low-initial-ESG acquirers' sample, respectively. Regressions include industry and year fixed effects. The t-statistics are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Variables	Success probability	Success probability	Success probability
	(1)	(2)	(3)
ESG level	0.161**		
	(1.99)		
ESG upgrade		-0.668	0.822***
		(-0.90)	(2.75)
ESG downgrade		-0.034**	-0.139
		(-1.91)	(-0.37)
Acquirer size	0.059	0.422	-0.026

	(0.49)	(1.61)	(-0.17)
Acquirer Tobin’s Q	-0.013	0.658**	-0.034
	(-0.32)	(2.38)	(-0.87)
Acquirer cash	2.801***	6.759***	1.962**
	(3.45)	(3.46)	(2.08)
Acquirer leverage	0.139	-0.449	0.285
	(0.29)	(-0.35)	(0.53)
SOE	-0.222***	-0.135	-0.302***
	(-3.30)	(-1.04)	(-3.43)
Deal size	1.013***	0.429	1.214***
	(3.14)	(0.60)	(3.08)
allstock	0.053	0.327	-0.149
	(0.21)	(0.63)	(-0.49)
diversify	-0.674**	-0.489	-0.887**
	(-2.20)	(-0.91)	(-2.16)
allcash	0.856***	0.111	1.040***

	(3.27)	(0.18)	(3.25)
Constant	3.427	-7.477	7.850**
	(1.20)	(-1.32)	(2.10)
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Observations	1,794	448	1,156
R-squared	0.125	0.192	0.165
Log pseudo likelihood	146.7	60.83	134.1

4.7 Conclusion

In this paper, I explore whether ESG pays back in the context of M&A activity. I focus on both ESG performance and its dynamics and propose two hypotheses. First, based on instrumental stakeholder theory, my first hypothesis suggests that high-ESG acquirers earn greater trust from stakeholders and are more able to encourage contributions from stakeholders to the firm's operations, in line with which high-ESG acquirers will attain better post-M&A performance.

In terms of the dynamics of ESG performance, the initial ESG performance dependent view suggests that the utility of stakeholders of the same firm diminishes with the increase in ESG effort, thus leading to greater contributions from stakeholders in low-ESG firms but lesser contributions from stakeholders in high-ESG firm. This has two implications. First, a marginal increase in ESG effort for low-ESG acquirers will result in better post-M&A performance, while high-ESG acquirers may have worse post-M&A performance. Second, a marginal decrease in ESG effort for high-ESG acquirers will result in worse post-M&A performance, while low-ESG acquirers may have worse post-M&A performance.

After correcting for endogeneity bias, I find that compared with M&A by low-ESG acquirers, those by high-ESG acquirers lead to higher post-M&A stock and operational performance. Meanwhile, low-initial-ESG acquirers who undergo an ESG upgrade prior to the M&A have significantly higher post-M&A stock and operational performance, whereas high-initial-ESG acquirers who undergo an ESG downgrade prior to the M&A have significantly lower post-M&A stock and operational performance. These results are robust to a variety of alternative model specifications. I also show that better acquirers' ESG rating or ESG rating upgrade for firms with low initial ESG help acquirers to successfully complete the deal.

Overall, these results suggest that firms' ESG efforts pay back in the form of their M&A process and that the influence of the dynamics of ESG prior to M&A on post-M&A performance is dependent on acquirers' initial ESG level. As such, instrumental stakeholder theory and the law of diminishing marginal utility are supported.

4.8 Appendix

Variable	Definition
BHAR_1year	Acquirer BHARs over the one-year period after the M&A announcement date. Following Bowman *et al.* (2009), I calculate the buy-and-hold abnormal returns (BHARs) by subtracting the buy-and-hold return of the reference portfolio from the buy-and-hold return of the acquirer. The whole reference portfolio includes 50 portfolios, classified according to the size (market valuation) and book-to-market ratios.
ROA_1year	Acquirer's return on asset (ROA) over the one-year period after the M&A announcement date.
ROE_1year	Acquirer's return on equity (ROE) over the one-year period after the M&A announcement date.
ESG level	Value equals 1 if the SSI ESG rating is C, 2 if the rating is CC, 3 if the rating is CCC, 4 if the rating is B, 5 if the rating is BB, 6 if the rating is BBB, 7 if the rating is A, 8 if the rating is AA, and 9 if the rating is AAA.
ESG level 2	Value equals 1 if the SSI ESG rating is C, 2 if the rating is CC, 3 if the rating is CCC, 5 if the rating is B, 6 if the rating is BB, 7 if the rating is BBB, 9 if the rating is A, 10 if the rating is AA, and 11 if the rating is AAA.
Upgrade ESG	Dummy variable that takes the value of one if the acquirer has an ESG rating upgrade one year prior to the M&A deal, and zero otherwise
Downgrade ESG	Dummy variable that takes the value of one if the acquirer has an ESG rating downgrade one year prior to the M&A deal, and zero otherwise.

Province-industry ESG	Median of ESG rating of other firms within the same industry-country pair.
Acquirer size	Natural logarithm of the acquirer's book value of asset.
Acquirer Tobin’s Q	The market value of equity divided by total asset.
Acquirer sash	Ratio of corporate cash to total asset.
Acquirer leverage	Ratio of total debt to total asset.
Acquirer SOE	Dummy variable that takes the value of one when the ultimate controller is the state or government.
Deal size	Natural logarithm of the expense value of the deal.
Allstock	Dummy variable that takes the value of one when the form of payment is stock-only, and zero otherwise.
Diversify	Dummy variable that takes the value of one when the deal is classified as a horizontal and conglomerate M&A, and zero otherwise.
Allcash	Dummy variable that takes the value of one when the form of payment is cash-only, and zero otherwise.
Institutional investor	The percentage of shares held by institutional investors to total shares.
BIND	The percentage of independent members on a board.
Blockholder	Dummy variable that takes the value of one if at least one investor holds more than 5% of the firm's outstanding shares and zero otherwise.

Chapter 5: Conclusion

This thesis empirically studies three standalone topics, including cash reserves, M&A and innovation, and ESG, which are related to corporate value creation. In particular, I respond to the following three research questions: (1) Do corporate managers have cognitive biases (i.e. belief in luck) that affect corporate cash reserve decisions and firm value? (2) Does state ownership affect the acquirer's post-M&A innovation performance? (3) Does ESG investment increase firm value?

Chapter 2 provides empirical evidence that managers exhibit biases when assessing risk. In particular, this research shows that managers temporarily increase the amount of corporate cash holdings as a result of a biased risk perception caused by an irrational belief in bad luck. Such a reaction cannot be viewed as rational, since the real liquidity risks are not greater during a chairperson's zodiac year. Rather, this reaction is consistent with the theory about belief in luck (Darke & Freedman 1997; Damisch *et al.* 2010) which predicts that a belief in bad luck will tend to make managers overestimate the probability of a negative outcome, even though the actual probability of said outcome remains unchanged. Furthermore, the results show that such a decision is suboptimal and inefficient in terms of resource allocation and shareholder value. Financial managers tend to retain cash from earnings by reducing their levels of risky investments in such areas as R&D and M&A, inducing shareholder loss. These results are robust to a variety of controls, including the type of firm, the industry, and the chairperson's demographic characteristics.

By analysing the post-M&A innovation performance of Chinese acquirers, research in Chapter 3 shows that state ownership in China does drive the acquirer's post-M&A innovation. However, SOE acquirers oriented toward responsible innovation are likely to increase their R&D investment following an acquisition but produce fewer patents, thus leading to a negative

market reaction in the short term. In the long term, both market and operational performances suggest an upward trajectory for RIOSOE acquirers subsequent to M&A.

In Chapter 4, the research examines whether firms' ESG efforts pay back in the context of M&A activity. Both ESG level and its dynamics are analysed. The research provides evidence to support the instrumental stakeholder theory by showing that high-ESG-rating acquirers attain better post-M&A performance. In terms of the dynamics of ESG performance, the initial ESG performance dependent view is supported. The results show that compared with M&A by low-ESG acquirers, those by high-ESG acquirers lead to higher post-M&A stock and operational performance. Meanwhile, low-initial-ESG acquirers who undergo an ESG upgrade prior to M&A have significantly higher post-M&A stock and operational performance, whereas high-initial-ESG acquirers who undergo an ESG downgrade prior to M&A have significantly lower post-M&A stock and operational performance. These results are robust to a variety of alternative model specifications. I also show that acquirers with a better ESG rating or firms with low initial ESG who undergo an ESG upgrade can help acquirers to successfully complete the deal and conduct positive-return deals.

This thesis makes the following contributions to the literature on corporate value creation. First, the thesis contributes to the literature on corporate cash reserves by offering a behavioural explanation for corporate cash holding. The findings in Chapter 2 are crucial for understanding how cognitive bias affects managerial decision-making. In Chapter 2, I demonstrate that a chairperson's belief in luck has a negative impact on a company's liquidity policy, which ultimately harms firm value. The findings in Chapter 2 suggest that the economic cost of this bias could be substantial, given the large and growing diversity of risks that must be assessed daily by the key decision makers of companies. Second, this thesis contributes to the literature on the heterogeneity of post-M&A innovation performance across firms. Chapter 3 examines the role of state ownership and responsible orientation in differentiating post-M&A innovation activity. Moreover, the findings of Chapter 3 provide additional evidence that state ownership

and government intervention provide SOE acquirers with greater financial resources and a superior competitive standing on the M&A market, and that the responsible innovation orientation modifies the post-M&A innovation pattern. Lastly, this thesis contributes to the ongoing discussion regarding whether firms' socially responsible efforts result in financial benefit. Using instrumental stakeholder theory and the law of diminishing marginal utility, Chapter 4 provides evidence that corporate ESG drives acquirers' post-M&A performance via stakeholders' support but that the impact of a marginal increase (decrease) in ESG effort is only significant for acquirers with a low (high) existing ESG level.

This thesis also provides important implications for corporate shareholders and policy makers. For corporate shareholders, the findings in Chapter 2 are particularly important as they call for more attention to be paid to the negative impact of irrational decisions made by managers vulnerable to cognitive bias on firm value. Meanwhile, the results in Chapter 4 demonstrate shareholders' rationale for conducting socially responsible activities. For policy makers, I demonstrate, in Chapter 3, the important role of state ownership, representing government intervention, and innovation orientation in corporate innovation after M&A has taken place. The findings provide policy makers with a better understanding of how state ownership and responsible innovation orientations interact and jointly affect post-M&A innovation activities and performance, thereby assisting them in the development of policies to guide corporate innovation. In addition, the findings in Chapter 4 regarding the value creation of firms' ESG provide insight and reference for policy makers to encourage firms to be socially responsible.

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