UTS UNIVERSITY OF TECHNOLOGY SYDNEY

State-owned Enterprises, Top Managers, and Innovation: Evidence from China

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Doctor of Philosophy

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Certificate of Original Authorship

I, **Mengyuan Zhu**, declare that this thesis is submitted in fulfilment of the requirements for the award of **Doctor of Philosophy**, in the **UTS Business School** at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Abstract

Innovation has long been acknowledged as a key driver for firms to obtain sustainable competitive advantage and, in turn, contribute to national economic development. Recently, research interest in the role of state capitalism, in the form of state-owned enterprises (SOEs) or state ownership, in innovation has grown rapidly. However, the topic of SOE innovation is still underexplored.

The existing literature on state ownership/SOE and innovation is scattered across multiple disciplines with diversified research themes, lacking theoretical and empirical integration. Therefore, in this thesis, I first conduct Study One, a systematic literature review to integrate previous studies. Based on this systematic review, I identify three research gaps in prior studies that need to be addressed in future research. First, previous studies ignore the heterogeneities of SOEs' leadership. Second, the heterogeneities among SOEs have been largely overlooked. Finally, there is a lack of causal inference studies related to SOE innovation.

To address the above research gaps, I conduct two other empirical studies (Study Two and Three). Specifically, in Study Two, I assess whether CEOs' private firm experience can improve or impede SOEs' innovation performance, and further examine the contingent effects of CEOs' international exposure and level of stateness. In Study Three, I examine how the reductions in pay disparities between managers and ordinary employees within SOEs affect their innovation performance using a quasi-natural experiment, and further investigate the underlying mechanisms and conduct heterogeneity analyses.

This thesis makes several key theoretical and practical contributions. First, through a systematic review of previous studies, this thesis provides a comprehensive understanding of the role of state ownership in innovation. Second, this thesis offers a

robust foundation to identify key research gaps in existing literature and sets a future research agenda. Third, by considering CEOs' private firm experiences, this thesis draws attention to the important but largely overlooked role of individual-level attribute of SOE leadership in shaping innovation and provides a novel lens to compare the heterogeneity among SOEs. Furthermore, through the adoption of a quasi-natural experiment, this thesis sheds light on the causal effect of pay disparity on SOE innovation performance as well as its underlying mechanisms, which are underestimated in SOE innovation studies. In terms of practical implications, this thesis highlights the significance of SOE managers and policymakers to prioritize the development of leadership within SOEs and cultivate an environment of pay equity, to boost firm innovation.

1. Introduction

1.1 Research Motivation

Innovation has long been acknowledged as a key driver for firms to obtain a sustainable competitive advantage and, in turn, contribute to national economic development (Archibugi, 2017; Crossan & Apaydin, 2010; Huarng et al., 2020). Various institutional factors are shown to promote innovation (Barasa et al., 2017; Maksimov et al., 2017; Salandra, 2018), among which the role of the state has received prominent attention (e.g., Jugend et al., 2020; Liang & Liu, 2018).

State support for innovation can take different forms. One pathway, which has long received prominent focus, is through external support mechanisms, such as granting research and development (R&D) subsidies (Ahn et al., 2020), developing innovation programs (Guo et al., 2016), and shaping innovation policy (Ruan et al., 2014). Through external support, governments can provide both human and financial resources for firms to boost their innovation capabilities and outcomes (Ahn et al., 2020; Guo et al., 2016). Besides such external support, the state also plays a role internally through *direct state ownership*, defined as firm's equity directly owned by the government (Cuervo-Cazurra & Li, 2021; Sun et al., 2021; Zhou et al., 2017). However, we know far less about the role of state ownership in innovation (Lazzarini et al., 2021; Zhou et al., 2017).

State-owned enterprises (SOEs), defined as firms owned and controlled by the government (OECD, 2017), are growing in importance as an economic pillar, both in emerging and developed countries, especially in emerging economies (Cuervo-Cazurra et al., 2022; Florio, 2014; Zhou et al., 2017). For example, based on ownership information from almost 31,000 listed firms in 100 different markets, which represent 98% of global stock market capitalization, the public sector owns 11% of global market capitalization (OECD, 2023). In several important transition economies, such as China,

Russia, Vietnam, and Serbia, SOEs contributed 24%–36% of GDP from 2010–2020 (Zhang, 2023). Additionally, the number of SOEs on the Fortune Global 500 (FG500) List increased from 27 to 102 between 2000 and 2017. Although SOEs are not a "China phenomenon" but a "world phenomenon", SOEs in China attract the most attention due to their high contribution to the national economy and employment, the broad sector distribution, and China's critical role in the world economy. For instance, in 2019, Chinese SOEs contributed 4.5% of the global GDP (Zhang, 2023), and the 2021 FG500 List includes 95 Chinese SOEs. All of the above highlights the important role of SOEs in the global economy, especially in transition economies. Against this backdrop, the question of how SOEs can drive firm performance and economic growth through innovation has attracted increasing attention from scholars across multiple disciplines in the last decade. Despite the burgeoning scholarly interest in recent years in the topic of SOE innovation, this topic is still underexplored.

The limited existing literature on state ownership/SOE and innovation is scattered across multiple disciplines with diversified research themes, lacking theoretical and empirical integration. Therefore, the first aim of my thesis is to systematically review and synthesize prior studies to provide a comprehensive understanding of the role of state ownership in innovation and suggestions for future research, which leads to Study One.

Through the systematic review, several key research gaps are identified in Study One, and three of them form the basis for Study Two and Study Three in this thesis. First, existing studies ignore the heterogeneities of SOEs' leadership. Previous studies have implicitly assumed that SOE leaders, such as chief executive officers (CEOs) and top management teams (TMTs), are homogeneous in how they filter information and make decisions. However, since Hambrick and Mason (1984)'s seminal work, studies have increasingly suggested that the characteristics of top managers significantly influence

how they interpret the environment and make strategic decisions in the organization (for a review, see Bromiley & Rau, 2015). Therefore, to open the 'black box' of innovation decision-making processes and better explain the role of state ownership in innovation, the strategic leadership of SOEs needs to be further examined.

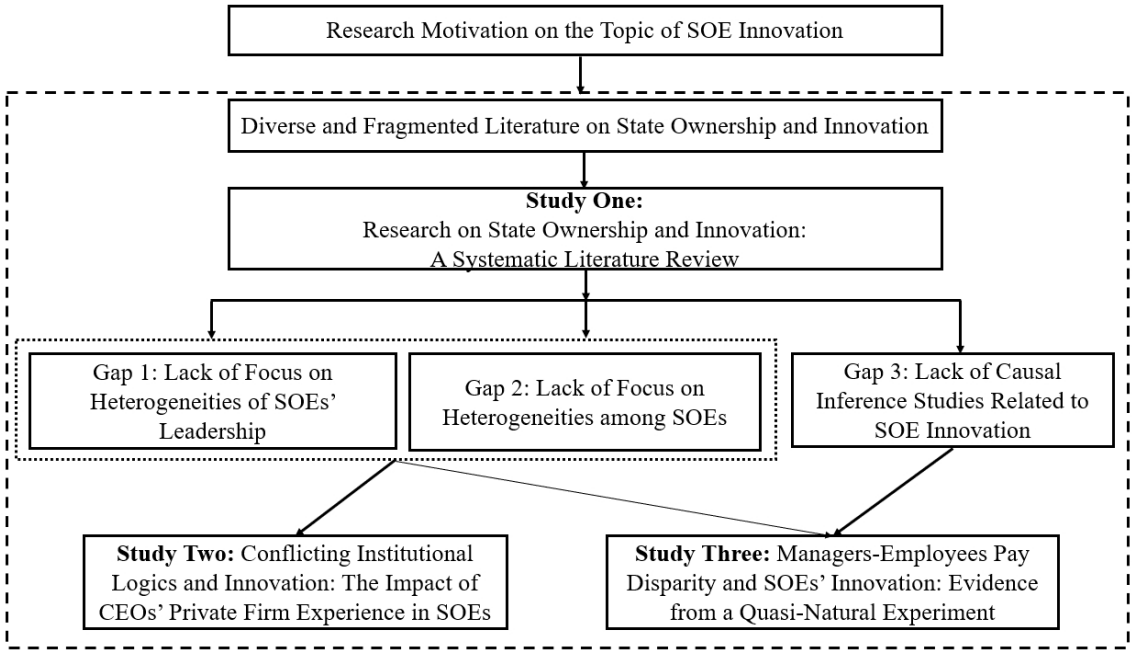
Second, the heterogeneities among SOEs has been largely overlooked. Most previous studies have examined the differences between SOEs and non-SOEs, and how innovation varies with these differences (e.g., Lazzarini et al., 2021; Sun et al., 2021; Zhou et al., 2017). They implicitly assumed that SOEs are homogeneous in obeying government pressures and making strategies. Nevertheless, SOEs are heterogenetic in many aspects, such as ownership structure, goals, resource endowment and leadership, which may result in different innovation strategies and outcomes among them. An elaborate examination of the heterogeneities among SOEs is crucial to provide a complete and in-depth understanding of the role of state ownership, especially given the inconsistencies in previous studies. Therefore, the effects of heterogeneities among SOEs on innovation need to be further addressed.

Third, there is a lack of causal inference studies related to SOE innovation. Solving endogeneity issues is critical to examine the causal mechanisms lying behind empirical associations. Existing studies on SOE innovation have tried to address endogeneity issues via different ways, such as using instrumental variables (Sun et al., 2021), adopting propensity score matching (PSM) techniques (Zhou et al., 2017) and Heckman two-stage approach (Lin et al., 2021). However, there is still a lack of causal inference studies. Future research should adopt various advanced methods, such as via setting a quasi-natural experiment, to mitigate the endogeneity, investigating the causal mechanisms related to SOE innovation.

1.2 Research Questions

To address the aforementioned motivations and research gaps, I conduct three studies in this thesis. **Figure 1.1** depicts the focus of each study and the interconnections between them. Study One involves a systematic literature review of previous studies on state ownership and innovation. Study Two and Study Three are empirical studies addressing three research gaps that emanate from Study One. Study Two mainly addresses Gap 1 and Gap 2, and Study Three mainly addresses Gap 3, while also addressing Gap 1 and Gap 2.

Figure 1.1 Framework of Thesis



The related research questions underpinning the three studies are as follows:

1. What do we know about the different roles of state ownership in innovation across diverse business domains? What are the research questions for future research agendas? (Focus of Study One)
2. How do the SOEs' strategic leadership and heterogeneities influence the SOE's innovation? More specifically, I examine the following two specific questions in the two empirical studies respectively:

a) When the CEO is exposed to conflicting logics acquired through prior and current experiences in different firm contexts, how does that affect a firm's innovation performance? Specifically, I examine whether and how the CEO's exposure to conflicting market capitalism logic, obtained through previous work experience in private firms, and the state socialism logic dominant in the current SOE, affects the SOE's innovation performance, and what conditions can moderate such an impact. (Focus of Study Two)

b) Do the reductions in pay disparities between managers and ordinary employees within SOEs improve or impede SOEs' innovation performance? What are the underlying mechanisms of such impact and what are the boundary conditions? (Focus of Study Three)

1.3 Research Methods

To solve the research questions mentioned above in this thesis, I adopt the systematic literature review (SLR) method to conduct Study One and the quantitative method to conduct two empirical studies. Study One is a systematic review conducted via both quantitative and qualitative methods. Specifically, I adopt a quantitative bibliometric technique (i.e., bibliometric coupling tool) to identify the main intellectual domains underpinning the literature on state ownership and innovation. Based on the bibliometric coupling results, I further use content analysis to organize an integrative framework of the previous literature to integrate the main findings. The SLR is a specific methodology that locates existing studies, selects and evaluates contributions, analyzes and synthesizes articles, and reports the evidence in such a way that allows reasonably clear conclusions to be reached about what is and is not known (Denyer & Tranfield, 2009). Systematic reviews differ from traditional narrative reviews by adopting a replicable, scientific, and transparent process that aims to minimize bias through exhaustive literature searches of

studies and by providing an audit trail of the reviewers' decisions, procedures, and conclusions (Cook et al., 1997; Tranfield et al., 2003). Bibliometric techniques are based on a quantitative analysis of bibliographic data to identify, describe, and evaluate research fields (Kessler, 1963; Small, 1973). They can help to detect research streams and theoretical clusters as well as informal research networks (''invisible colleges''), which might be otherwise hidden or difficult to detect (Crane, 1972; Zupic & Čater, 2015). Bibliometric coupling (Kessler, 1963) is a key bibliometric tool often used to examine the intellectual structure of recent/emerging literature (Devinney & Hohberger, 2017; Zupic & Čater, 2015). Furthermore, I use the qualitative content analysis approach to integrate main theories and findings of existing studies. Content analysis allows researchers to conduct both inductive and deductive work with minimal demand and information recall biases, which is done on quantitative, qualitative, and conceptual studies (Gaur & Kumar, 2018).

In Study Two and Three, the quantitative methods using longitudinal archival data are utilized to address the proposed research questions. To test the hypotheses proposed in Study Two and Three, I employ various econometric techniques, including negative binomial regression model, difference-in-difference (DID) model, propensity score matching (PSM) techniques, entropy balancing techniques, and Heckman two-step selection model, to analyze data using STATA 16.0.

1.4 Research Contributions

This thesis makes both theoretical and practical contributions to SOE innovation. Regarding theoretical contributions, first, the diverse and fragmented studies limit our understanding of the role of state ownership in innovation. This thesis provides a comprehensive understanding of the literature on state ownership and innovation by mapping and consolidating diverse intellectual domains to develop an integrative

framework on state ownership and innovation. Second, drawing on the bibliometric analysis and integrative framework based on previous literature, this thesis offers an objective and critical evaluation of the role of state ownership in innovation, providing a robust foundation to identify key research gaps in the literature, and sets a future research agenda that will contribute to moving the field forward. Third, this thesis introduces the important but overlooked role of individual-level attributes of SOE leadership in shaping innovation. By considering the effects of SOE leaders' characteristics (i.e., CEOs' private firm experience) on innovation, it applies a novel micro-foundational lens to extend previous SOE innovation research. Fourth, by examining the causal relationship between managers–employees pay disparity and innovation performance in SOEs by using a quasi-natural experiment, this thesis reveals the innovation implications of a critical but underexplored government's effort within SOEs, that is, reducing the pay inequity between managers and ordinary employees. Finally, while most prior studies focus exclusively on the differences between SOEs and non-SOEs, only a few pay attention to the sources of heterogeneities among SOEs. This thesis introduces a novel and critical source of heterogeneity among SOEs from the perspective of SOE leadership and investigates SOEs' governance heterogeneities. In terms of practical implications, this thesis highlights the importance of SOE managers and policymakers to focus on building leadership and reduce intra-firm pay disparity within SOEs so as to boost their innovation outcomes and, ultimately, improve the economy and society at large.

1.5 Organization of Thesis

This thesis includes four chapters: the first chapter provides an overall introduction of the thesis; the second chapter presents Study One—the systematic literature review on state ownership and innovation studies; the third chapter covers Study Two, a quantitative study on the relationship between CEOs' private firm experience and SOEs' innovation

performance; and the last chapter presents Study Three, investigating the causal effect of managers–employees pay disparity on SOE innovation performance.

2. Study One: Research on State Ownership and Innovation: A Systematic Literature Review

2.1 Introduction

Innovation is the engine of firms' competitive advantage as well as national economic development (Crossan & Apaydin, 2010; Romer, 1990; Solow, 1957). Given the pervasive presence of market failures in innovation, the significant role of governments in fostering innovation has been long recognised (Guo et al., 2016; Mahmood & Rufin, 2005; Q.-J. Wang et al., 2019). A government can actively drive innovation through the 'technoeconomic process' of capital-intensive, 'entrepreneurial' investments in various industries ranging from railroads and the Internet to modern-day nanotechnology and pharmaceuticals (Mazzucato, 2013, 2015). The role of governments has been especially noticeable in recent years, for example, through the heavy intervention in the research and development of vaccines in response to the COVID-19 global pandemic, as well as the antagonistic rivalry for technological supremacy between the United States and China (i.e., Tech cold war or techno-nationalism) (Luo, 2022; Petricevic & Teece, 2019). These examples indicate an undeniable fact: state capitalism has become prominent in driving business innovation.

An important pathway through which state capitalism influences innovation is by *directly owning equity in firms*, that is, *direct state ownership* (hereafter, *state ownership*) (Cuervo-Cazurra & Li, 2021). In fact, the economic importance of state ownership has increased globally. At the end of 2022, the global market capitalization of almost 31,000 listed firms in 100 different markets was nearly 11% owned by the public sector, with some markets, such as China, seeing state ownership exceeding 30% of listed equity (OECD, 2023). Over the last two decades, the proportion of state-owned enterprises

(SOEs), defined as firms owned and controlled by the government (OECD, 2017), in the Fortune Global 500 (FG500) List tripled. In Germany, about half of all economic sectors have at least one SOE, and other OECD economies have on average 10 to 25 sectors with at least one SOE (OECD, 2020). SOEs have also shown to be of great importance in technological breakthroughs on a global scale and will continue to innovate. For example, the China State Railway Group has developed a bullet train capable of travelling at 450 kilometres per hour, positioning itself at the forefront of global technology.

The growing importance of SOEs as an economic pillar and innovation player globally (Cuervo-Cazurra et al., 2022; Florio, 2014; Girma et al., 2009; Musacchio & Lazzarini, 2014; Stan et al., 2014) calls for greater attention and for scholars from various disciplines to investigate the role of state ownership in innovation over the past decade. Research on state ownership and innovation has grown rapidly in volume in recent years but remains fragmented. The existing studies rarely build on each other, which makes it difficult to assess and compare key findings across studies and limits our overall understanding of this research topic. While earlier reviews, in line with their focus, look at the literature either on SOEs/state ownership or state capitalism in general (Megginson & Netter, 2001; Musacchio et al., 2015; Shleifer, 1998; Tihanyi et al., 2019) or literature on a specific aspect of SOEs (e.g., internationalization) (Cuervo-Cazurra et al., 2022; Cuervo-Cazurra & Li, 2021), they barely refer to innovation issues related to SOEs. Tõnurist and Karo (2016) conducted a brief conceptual review on the rationales of SOEs and extended it to innovation but did not integrate the fragmented studies on SOE innovation. The research on the role of state ownership in innovation is not yet well integrated and consolidated. Hence, a review that focuses particularly on state ownership and innovation is warranted, based on not only the above-mentioned importance and

relevance of SOEs to the global economy and technological innovation but also the complexity and unique issues that emerge when studying SOE innovation.

Therefore, in this study, I set out to provide a comprehensive understanding of the intellectual domains underpinning research on state ownership and innovation and synthesize the key findings into an integrative framework comprising the theoretical lens, key findings, and contextual conditions. I did so by combining bibliometric coupling analysis and a content analysis approach. First, through the bibliometric coupling analysis of 187 publications from 2000 to 2022, I mapped the existing literature into four research domains which focus on different perspectives of state ownership and innovation. Then, combining the bibliometric results and content analysis approach, I integrated the fragmented studies into a framework focusing on the state ownership–innovation relationship. I found that the literature on state ownership and innovation is fragmented across various disciplines such as *Management*, including *Innovation* and *International Business* (Clò et al., 2020; Lazzarini et al., 2021; Zhou et al., 2017), *Economics* (Lin et al., 2010), and *Finance* (Fang et al., 2017). I also noted the conflicting empirical and theoretical views on the role of state ownership in innovation. Finally, based on the findings of the two approaches, I identified key research gaps and set a substantial future research agenda.

This systematic literature review on state ownership and innovation makes two main contributions. First, this study contributes to a better understanding of state capitalism by consolidating rapidly growing but fragmented studies on state ownership and innovation. Drawing on bibliometric analysis, I offer an objective and critical evaluation of the role of state ownership in innovation, discovering four main intellectual domains, and then I develop a framework for integrating the key findings based on four distinct domains. This allows me to assess the progress made across studies and disciplines and provides me

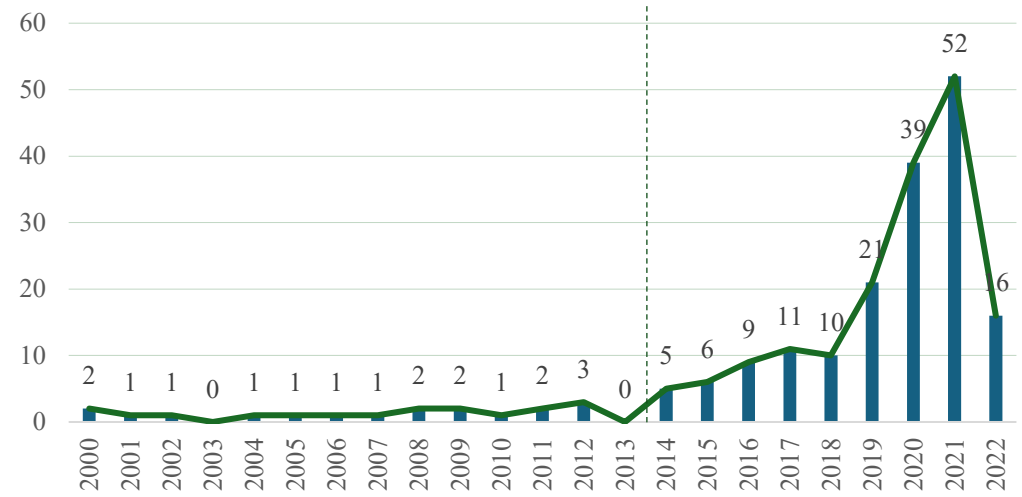
with a robust foundation to identify key research gaps in our knowledge. Second, I provide fertile avenues for future research, along with recommendations for research questions to address corresponding research gaps, with the goal of informing a more coherent and theoretically rich advancement of the growing topic of state ownership and innovation. I identify five potential areas that merit future research: discovering SOEs' leadership heterogeneities, investigating heterogeneities among SOEs, focusing on different types of innovation (e.g., radical innovation), discussing different research contexts other than several main emerging economies (e.g., China), and examining more causal inference studies related to SOE innovation.

2.2 Background

The literature on state ownership and innovation has evolved over two distinct periods: an emergent period (2000–2013) and a growing period (2014 to date), as reflected in the distribution of studies over time (Figure 2.1). The first set of articles emerged in 2000, with a small yet continuous stream of papers published each year thereafter until 2013. During this emergent period, no more than two papers on state ownership and innovation were published annually (except in 2012 when three papers were published). Scholars were largely interested in the variances in innovation strategies and performance between SOEs and non-SOEs (Lin et al., 2010; Tan, 2001; Xu & Zhang, 2008) and focused less on what determines SOEs' innovation (Girma et al., 2009; Li, 2011). Since 2014, during this growing period, research interest in and publications on state ownership and innovation have grown exponentially, especially after 2018. With the increasing importance of SOEs in the world economy and in innovation activities (Girma et al., 2009; Musacchio & Lazzarini, 2014; Stan et al., 2014), scholars have been paying more attention to the role of state ownership in innovation. Studies have further investigated the effect of state ownership on innovation (e.g., Clò et al., 2020; Lazzarini et al., 2021;

Zhou et al., 2017) and started to focus on innovation in various types of SOEs with different levels of state ownership (e.g., Wehrheim et al., 2020; Zhou et al., 2017). Studies have also paid more attention to other heterogeneities within SOEs and how various firm-internal and external factors influence how SOEs conduct innovation (Belloc, 2014; Benassi & Landoni, 2019; Genin et al., 2021; Jia et al., 2019).

Figure 2.1 Annual Distribution of Publications on State Ownership and Innovation



Note: Publication data for 2022 is until April 2022.

Few studies have reviewed or theorized the impact of SOEs (e.g., Cuervo-Cazurra & Li, 2021; Tihanyi et al., 2019), as shown in Table 2.1. Most studies take a general perspective and focus on SOEs' financial/economic performance (Megginson & Netter, 2001; Musacchio et al., 2015; Shleifer, 1998; Tihanyi et al., 2019) and internationalization (Cuervo-Cazurra et al., 2022; Cuervo-Cazurra & Li, 2021). For example, Tihanyi et al. (2019) conducted a meta-analysis on 210 articles to examine how direct state influence (through state ownership and political connections) impacts firm strategies (i.e., financial leverage, R&D intensity, and internationalization) and financial performance. Megginson and Netter (2001) conducted a survey study on the impact of privatization on economic life and the relative economic performance of SOEs and private firms. Some conceptual studies have discussed, for example, the failure of state ownership in economies (Shleifer,

1998), and draw on different theoretical perspectives to examine SOEs' strategic behaviour and firm performance (Musacchio et al. (2015). In terms of SOEs' internationalization, Cuervo-Cazurra conducted two important literature reviews using content analysis. Cuervo-Cazurra and Li (2021) reviewed 83 studies on state-owned multinational companies (SOMNCs) and mapped four topics: the motive of foreign expansion, the level of internationalization, country selection, and choice of entry method. They provided different theoretical perspectives with some suggesting an overall advantage of stateness and others an overall disadvantage (Cuervo-Cazzuro & Li, 2021). Cuervo-Cazurra et al. (2022) further reviewed 99 articles on the internationalization of SOEs and sovereign wealth funds, explaining how SOEs and sovereign wealth funds differ from private ones in internationalization. As the only conceptual paper focusing on SOEs' innovation, Tõnurist and Karo (2016) conducted a brief conceptual review of SOE rationales, extending it to innovation, but they did not integrate the fragmented studies on state ownership and innovation.

Although these existing reviews and conceptual articles shed light on the overall understanding of state ownership and financial performance or internationalization, they do not provide a comprehensive understanding of the role of state ownership in innovation. To address this gap, I conducted a systematic literature review aiming to discover the main intellectual domains and integrate the scattered studies on state ownership and innovation.

Table 2.1 Key Features of Most Relevant SOE Reviews/Conceptual Papers

Authors (year)	Method	Journal coverage	Period covered	Main focus/findings	Total sample of articles
Tõnurist and Karo (2016)	Conceptual	/	/	A brief literature review on the rationales of SOEs, extended to include innovation as a central rationale; A taxonomy that reveals the necessary policy and managerial conditions for and constraints of using SOEs as instruments of innovation policy.	/
Tihanyi et al. (2019)	Meta-analysis	AMJ, APSR, BP, CG, AIR, JBF, JCE, JCF, JF, JFE, JIBS, JOM, JMS, JP, PC, SMJ	1961–2015	Meta-analytic review of the effects of state ownership and political connections on firm strategies and performance; State ownership has a small negative effect on firm financial performance, and political connections have no direct consequences for performance; Both state ownership and political connections have a profound effect on firm strategies, such as financial leverage, R&D intensity, and internationalization, and these strategies play a mediating role in the state ownership–firm performance relationship.	210
Musacchio et al. (2015)	Conceptual	/	/	Focus on how different theoretical perspectives conceptualize SOEs' strategic behavior; Introduce four new varieties of state capitalism, which are wholly owned SOEs, majority SOEs, minority SOEs, and the state as a strategic supporter, and survey each type from various perspectives; Examine firm performance for each type of state capitalism relative to private firms and the contingent roles of country-level institutional conditions.	/
Megginson and Netter (2001)	Survey	/	/	Examine the impact of privatization on economic life around the world; Briefly survey theoretical and empirical research on the relative economic performance of SOEs and private firms.	/
Shleifer (1998)	Conceptual	/	/	For private ownership to be generally preferred to public ownership, incentives to innovate and contain costs must be strong; The failure of private firms to address "social goals" can be addressed through government contracting and regulation;	/

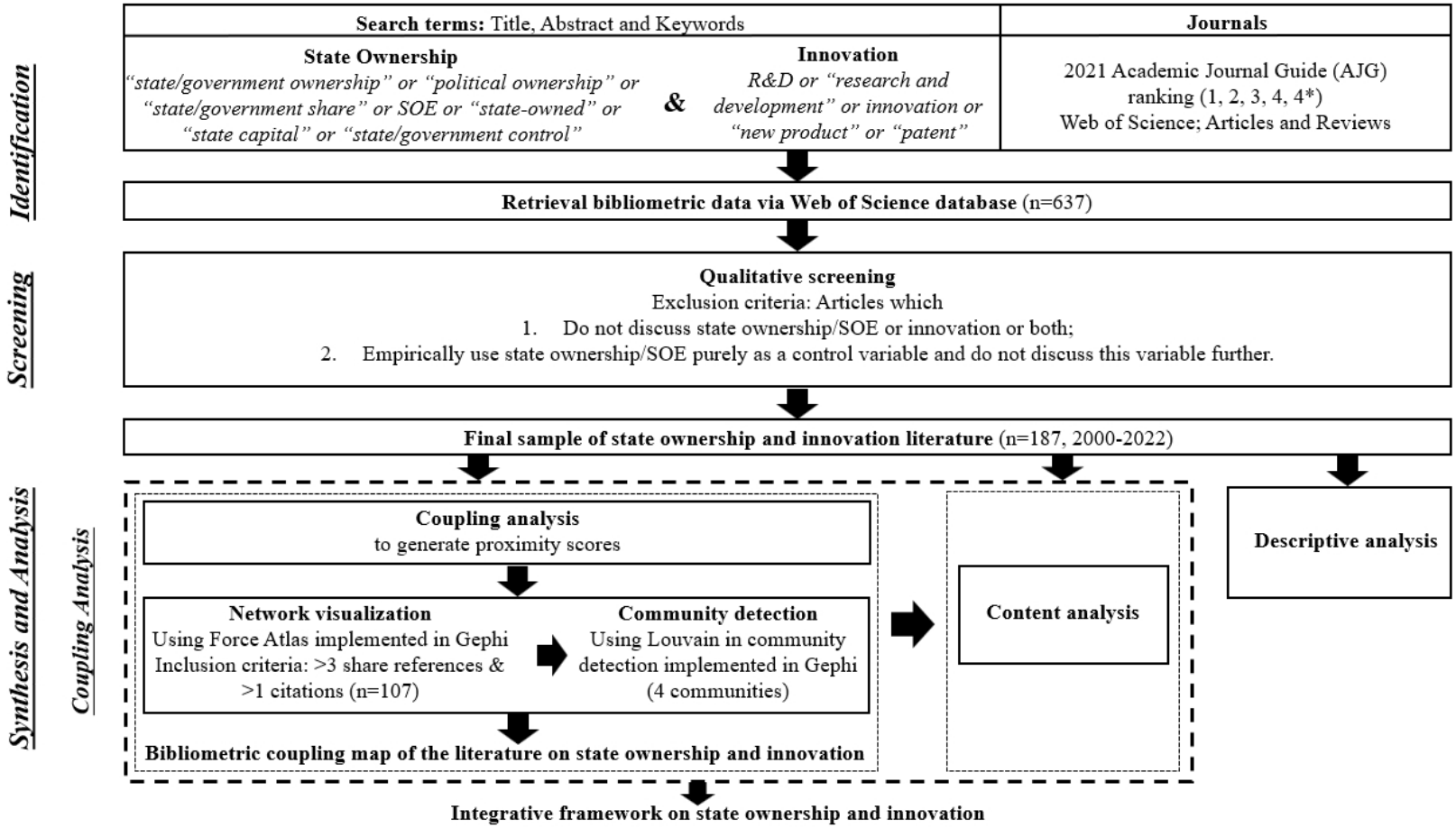
				The pursuit by government officials of political goals and personal income, as opposed to social welfare, further strengthens the case for private ownership.	
Cuervo-Cazurra and Li (2021)	Review (content analysis)	*International business journals:* APJM, GSJ, IBR, JIBS, JIM, JWB, MOR, MIR; *Management journals:* AMJ, AMR, ASQ, AER, JCF, JF, JFE, JOM, JMS, JPE, MS, OS, QJE, SMJ	1979–2019	State of studies on SOMNCs, including scope of the literature and mapping the contents of articles based on four topics: the motive of foreign expansion, the level of internationalization, country selection, and choice of entry method; Propose classifying theories based on whether the theory suggests an overall advantage (economic development, resource-based view, institutional economics) or disadvantage (agency theory, resource dependence, neo-institutional theory) of stateness.	83
Cuervo-Cazurra et al. (2022)	Review (content analysis)	Top journals in FT50 journals listed and ranked as three or above in the list of ABS 2019, in management, economics, economic geography, finance, and international business	1975–2021	Review of studies on the internationalization of SOEs and sovereign wealth funds; Explain how SOEs and funds differ from private ones in their internationalization; Suggestions on how to extend research topics and theories of the firm by incorporating nonbusiness objectives into the internationalization decisions in four areas; Capture how governments may use SOMNCs and sovereign wealth funds to nudge host-country governments.	99

Note: Academy of Management Journal (AMJ); American Political Science Review (APSR); Business and Politics (BP); Corporate Governance (CG): An International Review (AIR); Journal of Banking & Finance (JBF); Journal of Comparative Economics (JCE); Journal of Corporate Finance (JCF); Journal of Finance (JF); Journal of Financial Economics (JFE); Journal of International Business Studies (JIBS); Journal of Management (JOM); Journal of Management Studies (JMS); Journal of Politics (JP); Public Choice (PC); Strategic Management Journal (SMJ); Asia Pacific Journal of Management (APJM), Global Strategy Journal (GSJ), International Business Review (IBR), Journal of International Management (JIM), Journal of World Business (JWB), Management and Organizational Review (MOR), and Management International Review (MIR); Academy of Management Review (AMR), Administrative Science Quarterly (ASQ), American Economic Review (AER), Journal of Political Economy (JPE), Management Science (MS), Organization Science (OS), Quarterly Journal of Economics (QJE).

2.3 Methodology

This study combined bibliometric analysis and content analysis to systematically review the literature on state ownership and innovation. Following Denyer and Tranfield (2009)'s study, a multi-step review method was adopted to carry out a rigorous systematic literature review on state ownership and innovation, as shown in Figure 2.2. Bibliometric techniques are based on a quantitative analysis of bibliographic data to identify, describe, and evaluate research fields (Kessler, 1963; Small, 1973). They can help to measure the fragmentation of the research field by detecting research streams and theoretical clusters as well as informal research networks (''invisible colleges'') that might be otherwise hidden or difficult to detect (Crane, 1972; Zupic & Čater, 2015). In comparison to more traditional qualitative literature reviews, they also allow for a more transparent and reproducible review process, which is less subjective and biased and therefore increases the reliability of the results (Bretas & Alon, 2021; Wilden et al., 2019; Zupic & Čater, 2015). While a bibliometric analysis has many advantages, it can limit the advancement of a field because it cannot consolidate diverse knowledge clusters into a unified framework, which would allow a holistic understanding of the field and enable making connections across knowledge domains. Content analysis is done on quantitative, qualitative, and theoretical studies, allowing scholars to conduct both inductive and deductive work unobtrusively with minimal biases (Duriau et al., 2007; Gaur & Kumar, 2018). Thus, I synthesize fragmented knowledge into an integrative framework through content analysis combined with bibliometric results, which allows to identify existing gaps and guide future research.

Figure 2.2 Workflow of Research Method



2.3.1 Sample selection

To identify the relevant and scholarly research on state ownership and innovation, I conducted a systematic search for articles within all journals listed in the 2021 Academic Journal Guide (AJG) ranking, also known as ABS ranking, by the Chartered Association of Business Schools (CABS). The AJG/ABS ranking is widely used to assess the quality and reputation of journals and the publication output of researchers and academic institutions (Salter et al., 2017). The ranking combines expert panels and bibliometric metrics (e.g., SCImago Journal Ranks) to rank journals on a five-point scale (4*, 4, 3, 2, 1), with the highest ranking category—4*—closely aligned with 'A journals', as defined within the US scholarly (Salandra et al., 2022). Overall, the ranking comprises 1,703 academic journals across 22 fields that are either central or salient to business and management research (Walker & Wood, 2021). It provides a wider scope than other rankings, such as the Erasmus Research Institute of Management Journals Listing (EJL), Centre National de la Recherche Scientifique (CNRS), and Financial Times Survey of Top Business Schools (FT50). Thus, it allows us to search for peer-reviewed articles with at least a minimum level of academic rigor and quality and exclude non-scientific publications and articles from so-called predatory journals. Like in other systematic reviews, I also excluded books, book chapters, and conference papers.

Next, a series of search terms most relevant to state ownership and innovation were identified based on prior SOE/state ownership review papers (Cuervo-Cazurra & Li, 2021; Tihanyi et al., 2019). For state ownership, the search terms were: *state/government ownership, political ownership, state/government share, SOE, state-owned, state capital, state/government control.* In regard to innovation, the search terms were: *R&D, research*

and development, innovation, new product, *patent*.[1] I identified 637 articles that simultaneously contained at least one state ownership and one innovation search term in the article's title, abstract, and/or keywords in the Web of Science database. I downloaded the relevant bibliometric information, including abstracts and references, for these articles from the Web of Science, which is one of the largest and most comprehensive citation databases of peer-reviewed journals in social sciences and is frequently used and recommended for bibliometric studies (Zupic & Čater, 2015).

Finally, to ensure that the articles were indeed specific to state ownership and innovation, all articles were examined qualitatively. I independently reviewed the abstracts (or full articles if necessary) and excluded articles that 1) did not discuss state ownership/SOE or innovation or both, or (2) empirically used state ownership/SOE purely as a control variable and did not discuss this variable further. This process resulted in the final set of 187 focal papers, published between 2000, when the first article was published, and 2022 (Sun, 2000).

2.3.2 Bibliometric analysis and content analysis

First, I conducted a descriptive analysis of the selected articles on the state ownership and innovation field. Then, to gain a quantitative and visual understanding of the clusters in state ownership and innovation research, I used bibliometric analysis (i.e., coupling, citation, and author analysis) to map and analyze the scientific structure of the research field. Bibliometric coupling (Kessler, 1963) is one of the key bibliometric tools used in bibliometric literature reviews (Zupic & Čater, 2015). It assumes that the more references two articles share, the higher the similarity between these articles; thus, it uses the number

[1] The keywords take different forms as below: state* ownership, government* ownership, political ownership, government* share*, state* share*, SOE*, state-owned, state* capital*, state* control*, government* control*, R&D, research and development, innovat*, new product*, patent* (* can be substituted with any character or characters. For example, state* can refer to state or states).

of references shared by two articles as a measure of the similarity between them (Kessler, 1963). Coupling is related to co-citation analysis, which is based on the frequency with which two articles are cited together (Small, 1973). However, while in a co-citation analysis, the references of the relevant articles are the main level of analysis, coupling focuses on the research articles themselves; thus, coupling is preferable when one tries to examine the intellectual structure of recent/emerging literature (Devinney & Hohberger, 2017; Zupic & Čater, 2015).

The similarity scores from the coupling analysis built the base for graphical social network analysis. The network approach to analyzing publications or references has become increasingly popular within bibliometric studies as it allows for the direct visualization of the relationships between articles, provides improved depictions of larger research fields (Randhawa et al., 2016; Vogel & Güttel, 2012), and is integrated into various software packages that allow for a fast, easy, and reliable visualization of social networks (e.g., Bibexcel, Vosviewer, R, CitNetExplorer)[2]. In the network visualization, the nodes represent the articles, and the size of the nodes is based on the citations of each article. The edges represent the connection of the articles based on the proximity scores from the coupling analysis.[3] To aid interpretation and readability but still provide a meaningful representation of the research, I followed common practice in bibliometric studies and reduced the number of visualized publications (Bretas & Alon, 2021; Wilden et al., 2018; Zupic & Čater, 2015). Therefore, I limited the network to articles that have more than three shared references and at least two citations. This resulted in a network graph with 107 articles.

[2] I visualized the network with the Force Atlas algorithm implemented in the Gephi software (Jacomy et al., 2014).

[3] I also calculate centrality measures for all publications (see Appendix A1).

Finally, I applied the Louvain modularity optimization (Blondel et al., 2008) to detect communities (clusters and streams of research) within the network. Therefore, I iteratively varied the cluster coefficients to optimize the quality and interpretability of the cluster solutions and only considered solutions with a modularity above 0.4 to identify meaningful clusters. This procedure resulted in four distinct communities.

Based on the bibliometric results, I followed the qualitative content analysis approach (Duriau et al., 2007; Gaur & Kumar, 2018) to consolidate the existing studies into an integrative framework. I chose this approach because it allowed me to conduct both inductive and deductive work on quantitative, qualitative, and theoretical studies (Gaur & Kumar, 2018). Following the content analysis approach of Cuervo-Cazurra and Li (2021), I summarize the main ideas of each article in a table, using the following classification schemes: (1) authors, year, and journal; (2) research method; (3) research questions; (4) theoretical bases; (5) main arguments or hypotheses discussing the role of state ownership; (5) sample, dependent variable, and main independent variables related to SOE/state ownership either as the main driver or as moderator; (6) key findings. Combining bibliometric results and content analysis, I developed an integrative framework on state ownership and innovation.

2.4 Descriptive and Bibliometric Results

2.4.1 Descriptive results

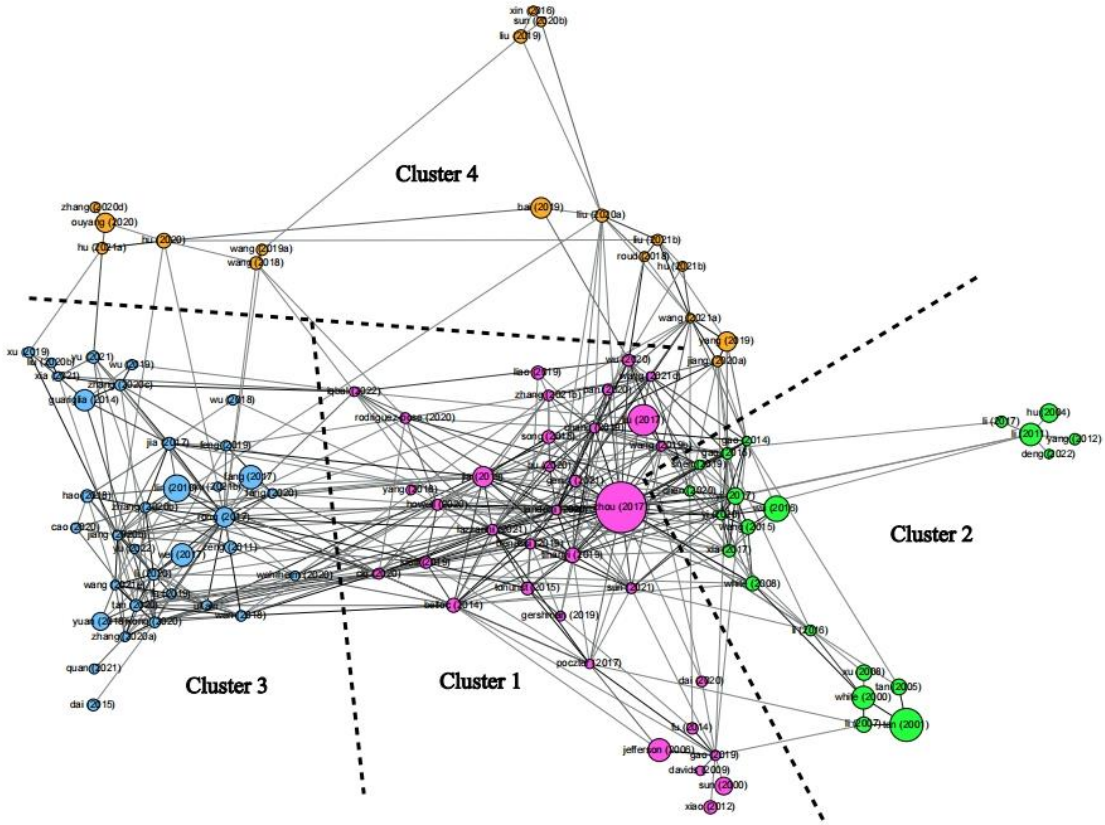
Table 2.2 shows the popular journals across different fields. The scholarly interest in state ownership and innovation is mainly distributed across the disciplines of *Innovation*, *Economics*, *Finance*, *International Business,* and *Management* disciplines. Some of the most popular journals include *Technological Forecasting and Social Change, Journal of Corporate Finance, China Economic Review, Asian Journal of Technology Innovation,* and *European Journal of Innovation Management.*

An analysis of the studies' research methods and contexts revealed some interesting insights, which are summarized in Table 2.3. First, most studies adopted a quantitative research approach, usually based on archival data or survey data. Few studies employed qualitative research methods, such as case studies, or used conceptual approaches. Second, most research on state ownership and innovation focused on China, followed by a focus on multiple countries and then individual emerging countries, while so far little research has examined a single developed country.

2.4.2 Focal themes in research on state ownership and innovation

The network graph of the coupling analysis can be seen in Figure 2.3. It depicts four fragmented clusters associated with four distinct perspectives on state ownership and innovation: 1) Management perspective; 2) Institutional perspective; 3) Finance and Economics perspective; and 4) Social perspective. Figure 2.3 shows the fragmentation of existing studies. Cluster 1 has a relatively strong connection with both Cluster 2 and Cluster 3, while Cluster 2 and Cluster 3 have only few connections to each other. Cluster 4 has more connections with Cluster 1 than with Cluster 2 and Cluster 3. The results show that scholars from Clusters 2, 3, and 4 may connect with scholars from Cluster 1, focusing on the management perspective, but they rarely talk to each other, which indicates fragmentation and the need to consolidate studies in different clusters. A summary of these research clusters along with the representative papers are presented in Table 2.4.

Figure 2.3 Bibliometric Coupling Map of the Literature on State Ownership and Innovation



Cluster 1: Management perspective on state ownership and innovation (purple)

The largest and most central cluster (**Cluster 1**) within the network focuses on the management perspective on state ownership and innovation, comprising two main themes. Cluster 1 is closest to Cluster 2, followed by Cluster 3 and Cluster 4, which means the management perspective on state ownership and innovation has some similarities with the other perspectives. Articles involved in this cluster mostly cover *Innovation, Management*, and *International Business*. The first theme investigates the role of state ownership in innovation strategies and outcomes, comparing SOEs with non-SOEs, mainly based on agency theory and institutional theory (Clò et al., 2020; Lazzarini et al., 2021; Zhou et al., 2017). The second theme of **Cluster 1** focuses on the heterogeneities

among SOEs and examines what factors or strategies can promote SOEs' innovation (e.g., Benassi & Landoni, 2019; Genin et al., 2021; Howell, 2020; Jia et al., 2019).

Cluster 2: Institutional perspective on state ownership and innovation (green)

Cluster 2, close to Cluster 1 and Cluster 4, largely includes studies on institutions and SOE innovation, mainly involving articles distributed in the fields of *International Business*, *Innovation*, and *Management*. Scholars have mainly investigated how to understand the effects of state ownership on innovation based on institutional theory (e.g., Gao et al., 2015; Gao et al., 2014; Wu et al., 2016; Yi et al., 2017).

Cluster 3: Finance and Economics perspective on state ownership and innovation (blue)

Cluster 3, the second largest cluster, close to Cluster 1 but far away from Cluster 2, mainly involves studies published in journals belonging to the *Finance* and *Economics* fields. One focus is on the easier access to resources that SOEs have compared with non-SOEs, and thus fewer financing constraints for innovation activities, especially for R&D investment (Guariglia & Liu, 2014; Jia & Ma, 2017; Zhang & Zheng, 2020). Another focus is on ownership structure and innovation, mainly based on agency theory, discussing the effect of state ownership on innovation (Cao et al., 2020), the impact of partial privatization (Tan et al., 2020; X. Zhang et al., 2020) and institutional ownership (Wen et al., 2018) on SOEs' innovation.

Cluster 4: Social perspective on state ownership and innovation (yellow)

Scholars in the fields of *Sector* and *Social Science* are mainly located in this final and smallest cluster (**Cluster 4**), which is relatively close to Cluster 1. Cluster 4 contains papers focusing on the social perspective of the role of state ownership in innovation, including two main themes. It should be noted that the research themes of this cluster have emerged only recently, starting in 2016. The first theme focuses on how state ownership moderates the effect of environmental regulation or policy on firm innovation

(X. Wang et al., 2019; J. Zhang et al., 2020). The second theme emphasizes whether and how state ownership affects a particular type of innovation— green innovation—mainly based on institutional theory (Liu et al., 2020; Wang & Jiang, 2021). It is worth noting that this is the only cluster highlighting green innovation, and the related studies were almost all published in the last five years. It is possible that considering the social responsibility of SOEs, whether and how SOEs can conduct more green innovation has attracted increasing scholarly interest with the growing environmental issues in recent years.

Table 2.2 Top Journals in Different Fields Publishing Articles on State Ownership and Innovation

Field	Journal Title	Number of Articles	AJG 2021 Ranking
Innovation & Technology	Technological Forecasting and Social Change	8	3
	Asian Journal of Technology Innovation	6	1
	European Journal of Innovation Management	6	1
	Industry and Innovation	4	3
	International Journal of Technology Management	4	2
	Technovation	3	3
	Innovation-Organization & Management	3	2
	International Journal of Innovation Management	3	2
	Others	11	/
	Sum	***48***	
Economics	China Economic Review	6	2
	Applied Economics	3	2
	Managerial and Decision Economics	3	2
	North American Journal of Economics and Finance	3	2
	Applied Economics Letters	3	1
	Others	18	/
	Sum	***36***	
Finance & Accounting	Journal of Corporate Finance	7	4
	Emerging Markets Finance and Trade	7	2
	Others	17	/
	Sum	***31***	
International Business	Journal of International Business Studies	4	4*
	Asia Pacific Journal of Management	4	3
	Chinese Management Studies	4	1
	Others	8	/
	Sum	***20***	
Management & Ethics	Journal of Business Ethics	4	3
	Academy of Management Journal	3	4*
	Journal of Business Research	3	3
	Others	7	/
	Sum	***17***	
Social science	Journal of Environmental Management	3	3
	Others	9	/
	Sum	***12***	
Sector	Journal of Cleaner Production	6	2
	Energy Policy	4	2
	Sum	***10***	
Others		13	
Total		**187**	

Table 2.3 Description of Sample

Characteristics	No. of papers	Percentage of sample
Research method	**187**	**100.0**
Quantitative method	168	89.9
Qualitative method	13	7.0
Mixed method: quantitative and qualitative	1	0.5
Conceptual	4	2.1
Meta-analysis	1	0.5
Research context	**187**	**100.0**
China	156	83.4
Multiple countries	13	7.0
Other single emerging country	11	5.9
Other single developed country	4	2.1
N/A	3	1.6

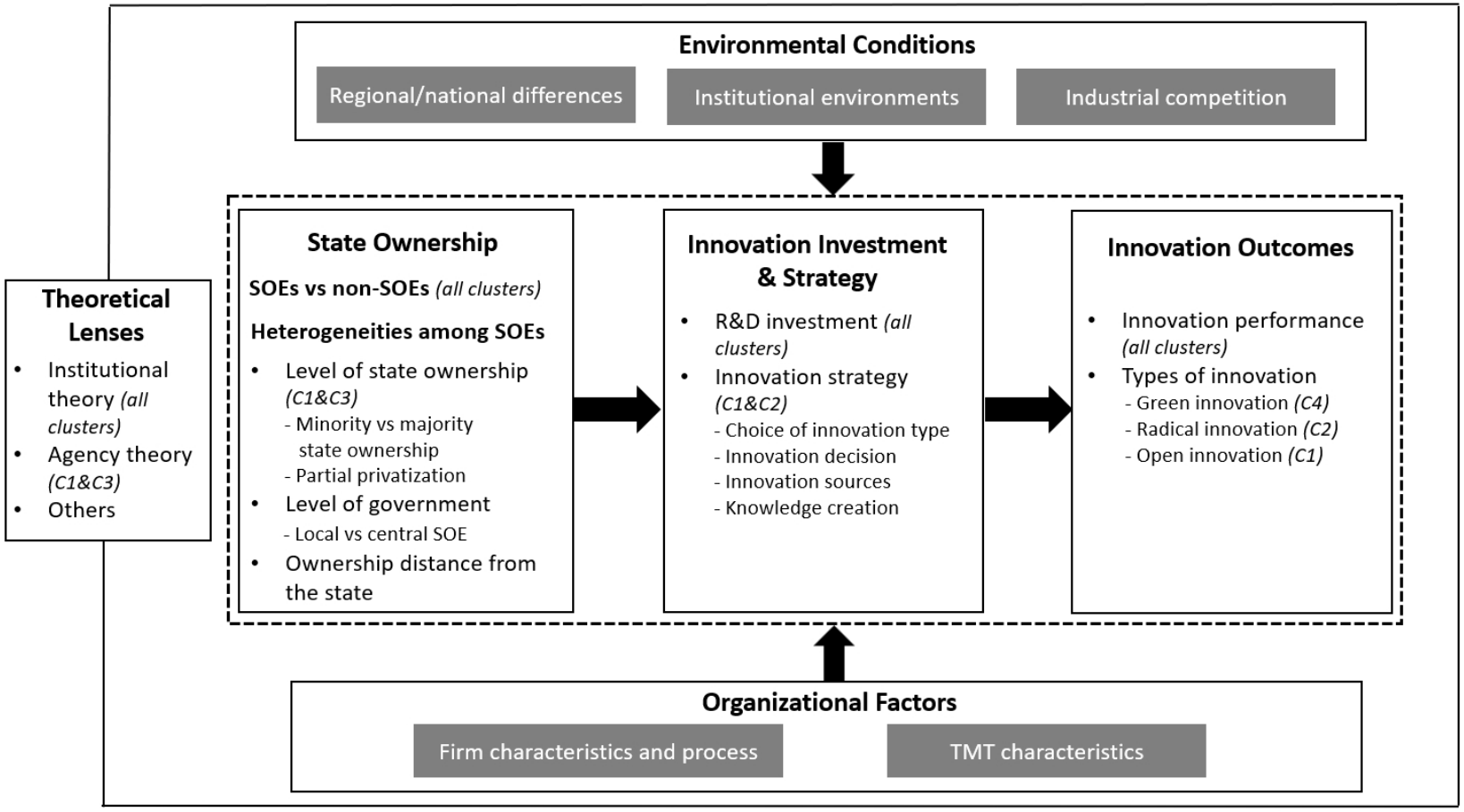
Table 2.4 Summary of Research Themes in the Domain of State Ownership and Innovation

Cluster themes	Main representatives	Main fields	SOEs vs non-SOEs or among SOEs	Main theories
Cluster 1: Management perspective on state ownership and innovation				
The role of state ownership in innovation; Factors promoting/impeding SOEs' innovation	Zhou et al. (2017); Jia et al. (2019); Lazzarini et al. (2021); Genin et al. (2021); Clò et al. (2020); Sun et al. (2021); Tõnurist (2015)	Innovation; Management; International Business	SOEs vs non-SOEs; Among SOEs	Agency theory Institutional theory
Cluster 2: Institutional perspective on state ownership and innovation				
The effects of state ownership on innovation based on institutional perspective	Yi et al. (2017); Gao et al. (2014)	International Business; Innovation; Management	SOEs vs non-SOEs Among SOEs	Institutional theory
Cluster 3: Finance and Economics perspective on state ownership and innovation				
SOEs' financing constraints; Ownership structure and innovation	Guariglia and Liu (2014); Fang et al. (2017); Wehrheim et al. (2020); Tan et al. (2020)	Finance; Economics	SOEs vs non-SOEs; Among SOEs	Agency theory Institutional theory
Cluster 4: Social perspective on state ownership and innovation				
Environmental regulation/policy, state ownership and innovation; State ownership and green innovation	X. Wang et al. (2019); J. Zhang et al. (2020); Liu et al. (2020); Wang and Jiang (2021)	Sector; Social Science	SOEs vs non-SOEs; Among SOEs	Institutional theory

2.5 Integrative Framework of State Ownership and Innovation

Bibliometric results show that studies on state ownership and innovation are diverse and fragmented, and scholars from different clusters lack conversations with each other, which limits our understanding of this research topic. Hence, I have developed a framework using content analysis to aggregate the key findings, as shown in Figure 2.4. The framework displays the main theoretical lenses used by scholars. Moreover, it includes the key focuses on state ownership, classified into two streams: *SOEs vs non-SOEs* and *heterogeneities among SOEs*. I link state ownership to major innovation-related constructs, including the innovation investment & strategy and innovation outcomes. Finally, my framework depicts the contingent environmental and organizational factors of the relationship between state ownership and innovation. Overall, I sought to provide a comprehensive view of the extant knowledge and highlight gaps for future research.

Figure 2.4 Integrative Framework of State Ownership and Innovation



2.5.1 Theoretical lenses

Table 2.5 summarizes the main theoretical lenses adopted by scholars. Agency theory and institutional theory are the two most popular theoretical lenses used to examine the impact of state ownership on innovation input and output (e.g., Clò et al., 2020; Jia et al., 2019; Zhou et al., 2017). Very few studies adopt other theories, such as resource-based view (Wang & Jiang, 2021), resource-dependence theory (Xia & Liu, 2017), and transaction cost economics (Sun et al., 2021).

Agency theory is mainly used by scholars in Cluster 1 and Cluster 3. According to agency theory, as long as ownership and management are separated, agency problems arise when agents take advantage of their positions and exploit inside information to maximize their own interests at the expense of the principals' interests (Jensen & Meckling, 1976; Ross, 1973). In the context of SOEs, the agency problem is more severe and more complicated than in non-SOEs. Studies have confirmed that SOEs suffer from the dual agency problem (Zhou et al., 2017) because the principal in SOEs is not clearly defined (Shleifer, 1998). On the one hand, government officials may utilize SOEs to maximize their own political interests, which inevitably interferes with firms' regular operations (Khwaja & Mian, 2005; Shleifer, 1998). Such interferences make SOEs maintain employment or economic stability at the expense of market-oriented strategies (Bu & Cuervo-Cazurra, 2020) and reduce innovation efficiency (Zhou et al., 2017). On the other hand, SOE managers often lack the capabilities, motivation, and supervision to pursue innovation activities (Cuervo-Cazurra et al., 2014; Shleifer, 1998; Zhou et al., 2017). SOE managers are often appointed by the government more for political reasons than their capabilities as professional executives, so they may lack the professional skills to allocate resources toward innovation efficiently (Zhou et al., 2017). Even if SOE managers have relevant capabilities, they may lack strong motivation to pursue activities

contributing to long-term profit, such as innovation, because 1) they lack aggressive profit-sharing incentives as are offered by non-SOEs (Shleifer, 1998), and 2) their performance is largely evaluated based on fulfilling the government's objectives rather than enhancing long-term firm value (Li et al., 2021). Also, SOE managers often face less scrutiny than non-SOE managers, so they may misuse R&D investment to pursue their own interests (Zhou et al., 2017).

The institutional theory, used by scholars in all clusters, focuses on the interaction between institutions and organizations and emphasizes how a firm's behaviour can be shaped by the surrounding formal and informal institutions (North, 1990; Scott, 1995). In order to survive, organizations must conform to the rules and belief systems prevailing in their environment, which can earn them legitimacy (DiMaggio & Powell, 1983). From an institutional theory perspective, state ownership can help firms buffer the impact of institutional voids, especially in emerging countries (Zhou et al., 2017). Specifically, state ownership can enhance a firm's legitimacy and sociopolitical approval, which gives firms superior access to licenses and resources unavailable in the market (Luo, 2003), promotes collaboration with external partners, and facilitates knowledge acquisition (McKelvey et al., 2015). Second, state ownership may protect firms when IPR laws are weakly enforced (Wang et al., 2012), and thus improve the ability to appropriate value from innovation. Moreover, governments may impose institutional pressure on SOEs to develop their innovation capabilities (Wang & Jiang, 2021; Zhou et al., 2017). However, such pressure may push SOEs to prioritize governmental mandates but ignore business objectives, such as innovation (Jiang et al., 2020; Li, Xia, et al., 2018b).

The authors apply other theories with much less frequency. These include, for instance, the resource-based view, emphasizing that firms compete with other firms based on resources and capabilities (Barney, 1991). SOEs can enjoy preferential access to

critical state resources and thus promote firm innovation (Chen et al., 2020; Wang & Jiang, 2021). Based on resource-dependence theory (Pfeffer & Salancik, 1978), Xia and Liu (2017) have investigated how the dependence on SOEs' resources affects innovation activities of new private, high-tech ventures. SOEs dominate the restricted state-controlled resources required by private firms to survive. When competing with SOEs, to reduce the resource dependence on SOEs, private firms will conduct innovation to enhance resource usage efficiency and capitalize on emerging technologies within the same sector. From the perspective of transaction cost economics (Coase, 1937; Williamson, 1975), Sun et al. (2021) examined the misappropriation concerns of multinational enterprises (MNEs) when partnering with host-country SOEs for R&D activities, including two types of contractual hazards (i.e., technological leakage and government expropriation). To obtain the critical and preferential resources provided by SOE partners, which can offset the misappropriation risks, MNEs use R&D investment as a symbolically and strategically reciprocal tactic to demonstrate their accommodation of the host state's strategic objectives of developing technology. Through the lens of resource-advantage theory, Dai et al. (2020) investigated the comparative resource advantage and innovation investment of cold chain logistics service providers (LSPs). LSPs with high state ownership are less motivated to invest in innovation activities because the government has already provided them with enough comparative resource advantages.

Table 2.5 Theories on State Ownership and Innovation

Theory	Initial arguments	Key arguments	Significance to SOE innovation	Representatives
Main theories				
Agency theory	Ross (1973); Jensen and Meckling (1976)	Principals delegate agents to make decisions on their behalf to achieve their expected results without enough control or monitoring mechanisms, and agents may maximize their own interests at the expense of sacrificing principals' interests.	SOEs suffer from the dual agency problem: 1) Governments may utilize SOEs to maximize their political interests and set political and social goals for SOEs, which may impede innovation. 2) Managers may lack professional skills, strong motivations, and supervision to pursue innovation or promote innovation capability.	Zhou et al. (2017); Sun et al. (2021); Chang et al. (2019)
Institutional theory	Meyer and Rowan (1977) DiMaggio and Powell (1983)	Organizations' behavior can be shaped by surrounding institutions, and to survive, organizations must conform to the rules and belief systems, and such institutional isomorphism can gain legitimacy.	1) SOEs have the priority to obtain resources and government support, buffering the impact of institutional voids. 2) Governments can impose institutional pressures on SOEs.	Zhou et al. (2017); Clò et al. (2020); Yi et al. (2017); Genin et al. (2021)
Other theories				
Resource-based view	Barney (1991)	Firms compete with other firms based on their own resources and capabilities.	SOEs enjoy preferential access to critical state resources.	Wang and Jiang (2021); Chen et al. (2020)
Resource-dependence theory	Pfeffer and Salancik (1978)	External resource interdependency is a key determinant of firms' behavior in resource exchange with other firms.	SOEs can easily co-opt government officials and obtain state support.	Xia and Liu (2017)
Transaction cost economics	Coase (1937); Williamson (1975)	Firms design contractual and monitoring mechanisms to reduce transaction costs.	SOE managers learn how to deal with institutions and can take higher risks in investment.	Sun et al. (2021)

2.5.2 State ownership

Most scholars in all clusters focus on the difference between SOEs and non-SOEs, investigating the effect of state ownership on innovation (e.g., Lazzarini et al., 2021; Yi et al., 2017; Zhou et al., 2017). State ownership can be exercised either directly via the control of firm shares by the state or indirectly via the control of firm shares through state-owned banks and sovereign wealth funds (Cuervo-Cazurra et al., 2014; Cuervo-Cazurra & Li, 2021). In our review, we focused on the direct ownership stakes by the state. Existing studies mostly measure state ownership as the percentage of stakes owned by the government (Jia et al., 2019; Xu & Zhang, 2008; Zhou et al., 2017), while few studies measure state ownership based on the share of state-owned assets to total assets (Yi et al., 2017). SOEs are generally defined as firms owned and controlled by the government (OECD, 2017). For listed SOEs, they usually refer to firms in which the state is the largest ultimate shareholder or ultimate controlling shareholder (Fang et al., 2017; Wang et al., 2022), and sometimes the ultimate controlling shareholder should hold at least 25% of total firm shares (Clò et al., 2020; Tan et al., 2020). A few other studies have defined SOEs as firms wherein the government owns more than 50% of the focal firm (Bu & Cuervo-Cazurra, 2020; Zhou et al., 2017). For unlisted SOEs, scholars usually use registration type or legal status to identify the firm type (Fang et al., 2017; Lin et al., 2010).

A few studies, mainly in Cluster 1 and Cluster 3, go beyond the difference between SOEs and non-SOEs and pay attention to heterogeneities among SOEs (Poczter, 2017; Tan et al., 2020; Wehrheim et al., 2020). These studies mainly focus on three aspects of SOEs' heterogeneity: level of state ownership, level of government, and ownership distance from the state. Based on the level of state ownership, most studies focus on the difference between majority state ownership, where the government owns over 50% of

shares, and minority state ownership, referring to the government owning less than 50% of shares but more than 0%, or 5%, or 10% (Lazzarini et al., 2021; Poczter, 2017; Rong et al., 2017; Wehrheim et al., 2020). Partial privatization through split shares reform or mixed-ownership reform is also a critical reflection of the level of state ownership (Tan et al., 2020; X. Zhang et al., 2020). Moreover, SOEs can be owned by various levels of government, such as the central/federal, provincial/state, and municipal/city governments (Cuervo-Cazurra & Li, 2021). Another differentiation focused on by scholars is the difference between central SOEs and local SOEs, depending on whether the central government or the local government is the SOE's ultimate controlling shareholder (Lin et al., 2021). Lastly, SOEs may be organized into chains of affiliated firms, forming corporate pyramids (Faccio & Lang, 2002). The ownership distance from the state, reflected by different layers of state-owned pyramids, can be an important heterogeneity among SOEs (Wang et al., 2022).

2.5.3 Innovation investment and strategy

Innovation is defined as the 'production or adoption, assimilation, and exploitation of a value-added novelty in the economic and social sphere; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems' (Crossan & Apaydin, 2010, p. 1155). This study has classified innovation constructs into innovation investment and strategy and innovation outcomes. Most research on innovation investment and strategy, contained mainly in Cluster 1 and Cluster 3, pays attention to R&D investment. Most quantitative scholars measure R&D investment as a firm's R&D expenditures scaled by a firm-specific factor, such as total sales (e.g., Lin et al., 2010; Wen et al., 2018; Zhou et al., 2017). Scholars have investigated the mixed findings of the effect of state ownership on R&D investment (Lin et al., 2010; Sun et al., 2021; Zhou et al., 2017). For example, Zhou

et al. (2017) and Sun et al. (2021) proposed that state ownership can provide preferential resources and thus promote R&D investment, while Lin et al. (2010) suggested that the government may directly own shares of the firm to foster employment or fulfil other social goals, which may impede a firm's R&D decisions. Some scholars have also examined the heterogeneities among SOEs in innovation investment (Hao & Lu, 2018; Tõnurist, 2015). For example, Hao and Lu (2018) claimed that compared with central SOEs, local SOEs that are completely controlled by the local government and pursue short-term economic performance tend to reduce R&D investment given the high uncertainty and length of time to realize R&D returns. Tõnurist (2015) conducted a qualitative study, proposing several heterogenous factors among SOEs, such as policy goals and dependence on the public budget, which can influence SOEs' innovation investment.

A few studies, mainly included in Cluster 1 and Cluster 2, have investigated innovation strategy. Several different innovation strategies are examined in the literature. Product innovation and process innovation are two different and important innovation types (Crossan & Apaydin, 2010). Xu and Zhang (2008) show that state ownership has a positive effect on process innovation strategy compared to product innovation strategy. Li et al. (2007) have discovered several factors, including market drive, internal governance, and resource and capability constraints of a firm, that influence SOEs' choice of product innovation vs process innovation. A few studies focus on SOE's decision to innovate. For example, Tan (2001) suggested that SOE managers are less willing to make risky decisions than entrepreneurs in private firms, while the innovativeness of SOE managers can be affected by the business environment (Tan, 2005). White (2000) proposed that an SOE's decision to make, buy, or ally to obtain new technology is influenced by external competitive and internal capabilities-related factors. The

investigation of SOEs' different innovation sources has also attracted some scholarly interest. Benassi and Landoni (2019) illustrated that SOEs can contribute innovations by exploring new opportunities and recombining different sources of knowledge. Gao (2019) explored three models through which large SOEs in China have approached the technological innovation frontier: comprehensive transfer of advanced technologies, development of emerging technologies, and most importantly, reinventing mature technologies. Knowledge creation is an important process for SOE innovation, which can be enabled by the management's autonomy and in coordination with the government (Landoni, 2020). Table 2.6 summarizes the main empirical studies on state ownership and innovation investment and strategy.

Table 2.6 Key Empirical/Conceptual Studies on State Ownership and Innovation Investment & Strategy

Author: Journal	Method	Research question	Theory	Sample	Main arguments and findings
Tan (2001): JBV	Quan	Examines characteristics of a regulatory environment and the impact on innovation and risk-taking among Chinese managers and entrepreneurs.	/	A survey of Chinese managers in SOEs and entrepreneurs in privately owned enterprises (POEs)	Managers in SOEs are not as innovative and are less willing to make risky decisions than entrepreneurs in POEs.
Tan (2005): JBV	Quan	Examines the changes in organizational environment and firm strategic adaptations in the last 24 years in China.	/	55 valid returned questionnaires for the 1990 sample, and 104 SOEs for the 2002 sample in China	Compared with 1990, the business environment in China in 2002 has become more conducive to entrepreneurial activities, and managers in SOEs have reacted favorably, with more willingness to commit to future growth and make more innovative and risk-oriented decisions.
Landoni (2020): SCED	Conceptual	Which factors allow for the creation of knowledge that makes SOEs unique and incomparable innovators able to acquire, exploit,combine, and ultimately create new knowledge.	The theory of the entrepreneurial firm; The theory of knowledge management	/	This paper offers a novel theoretical framework for knowledge creation in SOEs by the study of innovation in SOEs from the perspective of the theory of the entrepreneurial firm and the theory of knowledge management, which together provide new insights that explain the factors that enable innovation in SOEs. These factors are managerial autonomy and government coordination.
Benassi and Landoni (2019): II	Qua	This paper deals with the role of the SOEs in innovation processes.	/	French-Italian companies: STMicroelectronics in the semiconductor industry and Thales Alenia Space in the aerospace industry.	Through two indepth case studies in two different industries, they illustrate how SOEs can contribute to innovation by exploring new opportunities and recombining different sources of knowledge.

Dai et al. (2020): IMM	Qua	This exploratory study investigates how cold chain logistics service providers (LSPs) in emerging markets gain competitive advantage through service innovation, and how state ownership and regulatory pressure influence their innovation practices.	Resource-advantage theory	Four leading cold chain LSPs in China	Cold chain LSPs in emerging markets tend to innovate in providing new value-added and differential service offerings to specific customers, industries or regions. Cross-case analysis also reveals that high state-owned share and regulatory pressure may limit LSPs' capability for investing service innovation and developing novel business models.
Gao (2019): II	Qua	How large SOEs in China are approaching the technological innovation frontier.	/	12 large SOEs in China	In addition to the well-recognized technology transfer based strategy, pursuing emerging technologies and reinventing mature technology could also be effective, with reinventing mature technology as the most important strategy.
Davids and Tjong Tjin Tai (2009): BH	Qua	How State Mines relied on its innovative capacity in order to overcome the economic, technological and market changes.	knowledge-based view	Dutch State Mines	The coal cleaning innovations at State Mines show how absorptive capacity was of prime importance for the firm's innovative capacity. External knowledge acquisition as well as internal knowledge building proved to be relevant, although the balance changed over time.
Xu and Zhang (2008): APJM	Quan	What is the influence of state shares on a firm’s choice of innovation strategies? What types of innovations do they prefer? Do these companies invest in innovation independently or cooperate with others to share the costs and risks?	/	541 publicly traded companies in five high-tech industries in China during the period in 2000 - 2005	The presence of state shares have a positive effect on the corporate choice of a process innovation strategy over a product innovation one. However, this relationship is moderated by the overall ownership concentration ratio. Moreover, our findings suggest that companies with large state shares prefer to conduct innovations independently rather than collaboratively with others, and they usually achieve better innovation performance.

White (2000): AMJ	Quan	What factors influence a Chinese SOE's choice among alternative strategies for acquiring complementary assets?	Transaction cost theory; Resource dependency theory; Organizational capabilities perspective	Chinese state-owned pharmaceutical firms	The decision to make, buy, or ally to acquire new product technology is an outcome of a firm's simultaneous consideration of external competitive and internal capabilities-related factors.
Li et al. (2007): JET	Quan	This paper offers an analysis of the influence of management behavior on the relationship between factors such as market, governance and resources of a firm, and the choice of the type of technological innovation in Chinese SOEs.	/	274 SOEs in China	This study discovers that the choice of innovation types among Chinese SOEs depends on the turbulence in the environment, and on the organizational resources.
Li (2011): WD	Quan	Examines the pattern of innovation and learning among SOEs in Chinese high-tech sectors and empirically estimates the impact of three types of investment for acquiring technological knowledge-in-house R&D, importing foreign technology, and purchasing domestic technology-on the innovation capabilities of firms.	Absorptive capacity perspective	SOEs in 21 high-tech sectors in China during the period 1995–2004	The results show that importing foreign technology alone does not facilitate innovation in Chinese state-owned high-tech enterprises, unless in-house R&D is also conducted. Domestic technology purchases, however, are found to have a favorable direct impact on innovation, suggesting that firms have less difficulty in absorbing domestic technological knowledge than utilizing foreign technology and that absorptive capacity is contingent upon the source or nature of the external knowledge.
Deng and Lu (2022): EJIM	Quan	This paper compares four external technology acquisition channels' (foreign technology transfer, exporting, inter-	Technological catch-up theory;	16 Chinese high-tech industries from 2004 to 2015	Indigenous knowledge transfer improves foreign-funded enterprises' (FFEs) innovation, while transnational knowledge transfer is the main channel for SOEs

		industry R&D spillover and domestic technology transfer) contributions to Chinese high-tech enterprises' innovation in the moderating role of absorptive capacity (AC).	Absorptive capacity theory		technology acquisition. AC strengthens the positive relationship between transnational knowledge transfer and innovation in SOEs and improves FFEs' innovation and exported tacit knowledge absorption.
Lin et al. (2010): JDE	Quan	Examine the effects of property rights protection on corporate R&D.	Institutional economics theory	Over 2400 firms in 18 Chinese cities	Property rights protection is positively and significantly related to corporate R&D activity; government ownership of firms and direct appointment of CEOs are negatively associated with corporate R&D activities.
Wu (2019): AEL	Quan	Investigate financing constraints for R&D in China.	/	Chinese listed companies between 2007 and 2015, 4743 firm-year observations.	Chinese private firms are financially constrained for R&D, while SOEs are not. Mature private firms encounter more severe financing constraints for R&D than young private firms.
Zeng and Lin (2011): CMS	Quan	This paper seeks to examine the effect of ownership concentration, inside ownership and state ownership on the R&D spending practices for China's listed firms.	Agency theory	780 Chinese listed firms from 2000 to 2005, with 4,680 observations.	Firms with concentrated share ownership have lower R&D spending, and firms with inside ownership have lower R&D spending. However, firms with a higher level of state ownership spend more on R&D.
Hao and Lu (2018): FM	Quan	Whether government intervention plays an important role in determining corporate investment allocations and efficiency in China.	/	Chinese listed firms during the period between 2005 and 2012	The government tends to intervene to reduces R&D investment. However, the effects of government intervention on these investment allocations are primarily found in local SOEs rather than in central SOEs or in private enterprise.
Dai and Cheng (2015): IOM	Quan	This paper investigates the allocation of public subsidies and firms' R&D effort, focusing on the comparison between SOEs and non-SOEs.	/	SOEs and non-SOEs whose total sales are more than 5 million Yuan in China, during 2005–2007	The allocation of public subsidies is biased towards SOEs. Meanwhile, SOEs tend to maintain higher levels of R&D investment than matched non-SOEs.

Vukicevic et al. (2021): IBR	Qua	Why technologically-intensive Chinese SOEs are investing directly in the UK and how Chinese SOEs are using investment strategies to enter the UK and gain access to technology.	/	Technology-intensive Chinese SOEs	Chinese SOEs are motivated by their ambitions to close the technology gap by tapping into UK knowledge networks. In terms of entry strategies, the findings indicate that the initial focus on existing technology subsequently shifts to the creation of added R&D capacity and new technology.
Tõnurist (2015): TECHNOVATION	Qua	What is the role of SOEs in innovation policy management?	/	A state-owned energy company in Estonia	Outlines the most important factors that influence R&D objectives and investments in SOEs and their interaction with other innovation policy actors and measures.
Gershman et al. (2016): TFSC	Qua	Do SOEs really use foresight and technology roadmapping techniques to develop and implement innovation strategies? Are there any successful cases that could serve as an example for other countries faced with similar problems?	/	32 Russian SOEs and interviews with 11 SOE managers responsible for innovation development undertaken in 2014	Suggests a common structure for technology roadmaps that is suitable for SOEs.

Note: Journal of Business Venturing (JBV); Structural Change and Economic Dynamics (SCED); Industry and Innovation (II); Industrial Marketing Management (IMM); Business History (BH); Asia Pacific Journal of Management (APJM); Academy of Management Journal (AMJ); Journal of Technology Transfer (JET); World Development (WD); European Journal of Innovation Management (EJIM); Journal of Development Economics (JDE); Applied Economics Letters (AEL); Chinese Management Studies (CMS); Financial Management (FM); Innovation-Organization & Management (IOM); *International Business Review (IBR);* Technological Forecasting and Social Change (TFSC).

2.5.4 Innovation outcomes

This study has divided innovation outcomes into two parts: innovation performance (often measured by patents or new products) and types of innovation (e.g., green innovation). Next, the findings will be integrated in turn.

For innovation performance, researchers primarily consider the number of patents (Clò et al., 2020; Genin et al., 2021; Jia et al., 2019; Zhou et al., 2017) and patent citations (Fang et al., 2017; Lazzarini et al., 2021; Rong et al., 2017). A few scholars also consider new product sales (Xia & Liu, 2017; Yi et al., 2017; Zhou et al., 2017). For innovation performance, most studies focus on the difference between SOEs and non-SOEs, while a few scholars examine the heterogeneities among SOEs. Important studies discussing the effects of state ownership on innovation performance are mainly included in Cluster 1, Cluster 2, and Cluster 3. Previous literature using various theoretical perspectives has reached different conclusions regarding the impact of state ownership on innovation performance (e.g., Clò et al., 2020; Lazzarini et al., 2021; Yi et al., 2017; Zhou et al., 2017). Most studies suggest a hindering effect of state ownership on innovation efficiency and performance due to the dual agency problem in SOEs (Chang et al., 2019; Kroll & Kou, 2019; Sun et al., 2021; Zhou et al., 2017). Chang et al. (2019) specifically provided empirical evidence that lower levels of SOE innovation capability are due to the lack of entrepreneurial orientation and a high-commitment human resource management (HRM) practice can reduce the negative impact of state ownership on innovation capability. However, considering that compared to private firms, SOEs allow managers greater autonomy and put less strict monitoring pressure on them, SOE managers can be encouraged to pursue pioneering patents and more patents (Lazzarini et al., 2021). Improved corporate governance tools and high-quality public governance have been proven to reduce the agency risk in SOEs, and such agency risk refers to the possibility

that managers may pursue a greater quantity of innovation at the expense of novelty (Jia et al., 2019). A few studies with the institutional perspective claim that state ownership can be positive for innovation performance (Clò et al., 2020; Yi et al., 2017; Yu et al., 2022). For instance, Yi et al. (2017) proposed that state ownership can provide institutional advantages and thus enhance the effect of R&D intensity on innovation performance. Under certain conditions, such as high-quality government and institutions (Clò et al., 2020), SOEs can show better patenting performance than private firms. However, Genin et al. (2021) discovered that state ownership can exacerbate institutional logic dissonance in a restructured SOE, thus limiting the improvement effect of SOE restructuring on innovation.

Moreover, a few studies, mainly contained in Cluster 1 and Cluster 3, have examined the heterogeneities among SOEs in terms of innovation performance. Focusing on different levels of state ownership, these studies almost all agree that minority SOEs generate more innovation output than majority SOEs (Cao et al., 2020; Poczter, 2017; Zhou et al., 2017) because in minority SOEs, agency problems are relatively less salient but the institutional advantages still remain (Musacchio et al., 2015; Zhou et al., 2017). Tan et al. (2020) and X. Zhang et al. (2020) also found that partial privatization through split share structure reform and mixed-ownership reform promotes SOEs' innovation. Nevertheless, using the context of the European telecommunications industry, Wehrheim et al. (2020) proposed that firms under mixed ownership innovate less in response to discontinuous technological change than fully private firms or majority SOEs. Focusing on the level of government, studies have found that central SOEs have stronger motivations, more resources, and higher capabilities to conduct more innovation than local SOEs (Kroll & Kou, 2019; Lin et al., 2021). Concerning ownership distance from the state, Wang et al. (2022) found that SOEs innovate more when the number of

pyramidal layers between them and the state increases because, in lower-tier SOEs, such layers can loosen the grip of the state socialism logic and facilitate SOEs' acceptance of the market competition logic. Additionally, Belloc (2014) proposed four main sources of SOEs' comparative inefficiency in innovation according to firm-internal/external dimensions: poor monitoring of managers, lack of market discipline, corruption of public managers, and interference of malevolent politicians.

A few other researchers have also investigated specific types of innovation, such as green innovation, radical innovation, and open innovation, in SOEs. Among these, green innovation (one of the main focuses in Cluster 4) has attracted the most scholarly attention. Green innovation is defined as the development of new products or processes that protect the natural environment through pollution control, energy savings, and waste recycling (Berrone et al., 2013). SOEs can promote more green innovation than non-SOEs because of high levels of government pressure and abundant resources provided by the government (Hu et al., 2021; Wang & Jiang, 2021). However, Liu et al. (2020) argued that lacking government protection, private firms face a higher level of environmental pressure than their SOE counterparts because they are more likely to be penalized for environmental violations (Konisky & Teodoro, 2016). Pan et al. (2020) have integrated the institutional logic and efficiency logic and posit that a U-shaped relationship exists between state ownership and green innovation. Radical innovation helps firms to redefine current markets and explore/create new markets (Chandy & Tellis, 1998; Gao et al., 2015). Gao et al. (2015) pointed out that SOEs may find it easier to absorb formal institutional capital than informal institutional capital to boost their radical innovation. Shen et al. (2019) claimed that ties to SOEs have a positive effect on Chinese manufacturing firms' radical innovation. Lastly, open innovation (OI) can be regarded as a process to use external and internal ideas, and internal and external paths to market, to advance firms'

technology (Chesbrough, 2003). With OI practices, SOEs can drive the demand for technology, absorb incoming ideas and innovations, and extend their OI activities to the country's knowledge producers (Gershman et al., 2019). Table 2.7 summarize the main empirical studies on state ownership and innovation outcomes, and Table 2.8 shows the main research focusing on both innovation strategy and outcomes of SOEs.

Table 2.7 Key Empirical/Conceptual Studies on State Ownership and Innovation Outcomes

Author: Journal	Method	Research question	Theory	Sample	Main findings
Innovation Performance					
Sun (2000): RS	Quan	Explore how the innovative landscape evolves in the context of China.	/	Chinese firms	Both state-owned and collective-owned industries, rather than foreign ventures, contribute to the creation of new products in China.
White et al. (2008): MOR	Quan	Examine how different organizational influences induce group affiliates to emphasize employment and market innovation investments.	Institutional theory	1,038 Chinese group-affiliated member firms from 246 business groups	Government ownership and the government managerial mindset were negatively related to market innovation activities.
Girma et al. (2008): WBER	Quan	Is there is a link between increased levels of inward FDI and innovation activity by Chinese domestic enterprises?	/	239,085 enterprises in Chinese manufacturing industries from 1999 to 2005	Private and collectively owned firms with foreign capital participation and those with good access to domestic bank loans innovate more than other firms do. FDI affecting credit is of little significance for SOEs and is independent of their access to finance.
Xiao and Zhao (2012): JIMF	Quan	How do financial development affect firm innovation around the world?	/	Over 28,000 firms in 46 countries (2002–2005)	While stock market development significantly enhances firm innovation, banking sector development has mixed effects. In countries with lower state ownership of banks, banking sector development enhances firm innovation; while in countries with higher state ownership of banks, it has no significant or sometimes negative effects on firm innovation.
Guariglia and Liu (2014): IRFA	Quan	To what extent do financing constraints affect Chinese firms' innovation activities?	/	120,753 unlisted Chinese firms between 2000 and 2007, with 745,548 observations	Firms' innovation activities are constrained by availability of internal finance, which represents a particularly binding constraint on innovation activities of small firms, with fewer state shares.

Song et al. (2015): IJRM	Quan	Whether and how ownership structures affect the relationship between market orientation (MO) and innovation?	Agency theory	242 publicly-traded companies in China	Non-state-owned firms may achieve a higher level of innovation performance than their state-owned counterparts through their implementation of MO.
Jiao et al. (2016): TFSC	Quan	What is the moderating effect of ownership on the relationship between entrepreneurial ability and technological innovation?	/	788 listed Chinese companies	Chinese concepts of guanxi, social responsibility and strategic leadership abilities have positive effects on technological innovation. As proportion of state shares increases, those abilities become more conducive to technological innovation.
Li et al. (2016): APJM	Qua	What role does inter-firm collaboration (IFC) play in the new product development (NPD) process in Chinese pharmaceutical firms?	Resource-based view (RBV); Transaction cost economics (TCE); Institution-based view (IBV)	A state-owned and private pharmaceutical firm in China	Three key forms of IFCs are pertinent to NPD: personal network-initiated collaboration, arm's-length collaboration, and lead-operator-centered collaboration. The national institutional environment in China favors SOEs to acquire critical resources.
Wu et al. (2016): JWB	Quan	Examine how the level of host-country institutional development influences innovation at home and how firm-specific idiosyncrasies and internationalization strategies affect this relationship.	Institutional theory	599 internationalized Chinese EMEs that have established 2430 subsidiaries across 82 countries from 2000 to 2010	Host-country institutional development on average enhances innovation performance of the parent. Interestingly, EMEs with a higher level of state ownership gain more when entering countries with a lower level of institutional development.
Liu et al. (2016): AMJ	Quan	Whether, how, and when different types of employee-experienced HR systems jointly influence employee creativity? Does aggregated employee creativity enhance firm innovation, and, if so, does firm ownership alter this link?	Componential theory of creativity; Person-organization (P-O) fit theory	57 metallurgical firms (30 SOEs and 27 POEs) in a Northeastern province of China	Employee-experienced performance-oriented HR systems were more positively related to employee domain-relevant skills when employees experienced stronger maintenance-oriented HR systems. Aggregated employee creativity had a stronger positive relationship with firm innovation in POEs than in SOEs.

Rong et al. (2017): RP	Quan	Focus on a specific force of external governance on innovation ownership by institutional investors and how it interacts with state ownership.	Career concern view	All Chinese listed firms from 2001 to 2011	The presence of institutional investors enhances firm innovation, and the effect exists among private- and minority state-owned enterprises, but not among majority state-owned enterprises.
Xia and Liu (2017): JIBS	Quan	Is it the case that competition plays an important role in creating conditions favorable to innovation or all types of competition?	Resource dependence theory	805 Chinese private high-tech firms between 2001 and 2007, with 4,830 observations	Foreign competition has a U-shaped relationship with the innovation performance of private firms, whereas competition from state-owned enterprises positively affects private firms' innovation performance.
Yi et al. (2017): TECHNOVATION	Quan	Whether and how regulatory institutions (state ownership, region-specific marketization and industry-specific institutional policy) affect innovation performance of EMEs?	Institutional theory	193,506 Chinese manufacturing firms between 2005 and 2007	State ownership positively moderates the effect of R&D intensity on innovation performance. Region-specific marketization and industry-specific institutional policy enhance the innovation-enhancing effect of state ownership.
Poczter (2017): APJM	Quan	Can government ownership of a firm spur innovation?	Agency theory; Public economics perspective	6627 Firms in 11 emerging Asian economies, in 2003, 2005, and 2008	A minority level of government ownership has a positive influence on firm innovation. Moreover, it especially increases the likelihood of process innovation (as opposed to product innovation), which is traditionally difficult to finance.
Yuan and Wen (2018): JCF	Quan	Whether managerial foreign experience can promote corporate innovation?	Upper echelon perspective; Failure-tolerant perspective; Eyeball effect perspective	Listed firms on the Shanghai and Shenzhen Stock Exchange from 2001 to 2013, with 18,236 observations	Managerial foreign experience is positively associated with corporate innovation. Managers with foreign experience in private enterprises have more initiatives to innovate than in state-owned enterprises.
Yang et al. (2019): JBE	Quan	How managers' perceptions of institutional pressure relate to their focus on proactive environmental strategy (PES) and consequently to realized innovation capability, and how	Managerial cognition perspective	126 firms listed on the Shenzhen and Shanghai Stock Exchange markets	Managers' perceived business and social pressures are positively associated with their focus on proactive environmental strategy, which consequently fosters innovation capability development. Moreover, state ownership and government administrative control weaken the

		government intervention moderates the relationship between managerial focus on PES and innovation capability?			impact of managerial focus on proactive environmental strategy on innovation capability.
X. Wang et al. (2019): JEM	Quan	Examine the impacts of different types of industry policies and their mixes on enterprise innovation.	/	59 listed companies in the wind power industry (WPI) from Shanghai and Shenzhen Stock Exchanges from 2001 to 2016	Different types of policies have significantly different effects on innovation performance of wind power enterprises (WPEs). Policy mixes are implemented better in regions with weak innovation environments, especially for innovation performance of private-owned WPEs in the region. However, there is no significant impact on SOEs in regions with weak innovation environments.
Chang et al. (2019): IMM	Quan	Can high-commitment HR practices (HCHR) help SOEs reduce the negative influence of state ownership on entrepreneurial orientation and innovation capability? If yes, under what conditions might HCHR be more beneficial for SOEs?	Agency theory	Questionnaires from 166 companies in China	Entrepreneurial orientation mediates the negative relationship between state ownership and a firm's innovation capability; HCHR practices weaken the negative relationship between state ownership and entrepreneurial orientation; The positive moderating effect of HCHR is stronger in B2B SOEs than in B2C SOEs.
Howell (2020): RS	Quan	To what extent does innovation efficiency (i.e., resource utilization) vary for semi-POEs versus SOEs? How do the interactions between firms with high absorptive capacity and variations in ownership structure influence innovation outcomes?	Efficiency-based economic theories; Theories of knowledge governance	State- and non-state-owned Chinese firms	POEs are more efficient innovators than their SOE counterparts; local spillovers from related industries enhance firm innovation; despite possessing relatively high levels of absorptive capacity, POEs maintain higher innovation performance compared with their SOE counterparts.
Kong, Wang, et al. (2020): JCF	Quan	Investigate the impact of rank-and-file employees on corporate innovation.	Efficiency wage theory; Endogenous economic growth theory	10,413 firm-year observations from 2007 to 2013 in China	Paying higher relative wages to rank-and-file employees promotes better innovation outcomes in terms of patent quantity and quality. This effect is more significant among non-SOEs.

Wang et al. (2020): IRFA	Quan	Whether insiders pledging affects a firm's innovation and investment activities?	/	2733 publicly listed firms in China from 2007 to 2015, with 16,612 observations	There is a negative effect of both the existence of pledging and the intensity of pledging activities on firm innovation; share pledge activities have a more pronounced effect on firm innovations when firms are non-SOEs.
Jiang et al. (2020): JBE	Quan	How does stakeholder relationship capability (SRC) relate to firm innovation with governmental intervention and combined with firm-level characteristics?	Stakeholder theory; Institutional theory; Resource-based view (RBV)	126 listed Chinese firms from both the Shanghai and Shenzhen Stock Exchange markets	SRC is positively associated with firm innovation. Moreover, advanced legal development and high-tech status strengthen the positive link between SRC and innovation, whereas state ownership and firm age weaken this relationship.
Kong, Zhu, et al. (2020): EE	Quan	Investigate impact of foreign institutional investors (FIIs) on energy firms' innovation.	/	2910 observations from listed Chinese energy industrial enterprises from 2006 to 2016	A significantly positive relationship between foreign institutional investors and innovation outputs of energy firms; main findings are weakened in state-owned companies with high financing constraints.
Li et al. (2020): JCF	Quan	How do increases in labor cost affect firms' technology innovation, especially in emerging markets that face structural changes in labor supply and cost along with strong government intervention through state ownership and political connections?	The theory of wages	7949 firm-years between 2005 and 2013 in China	Government intervention through state ownership and political connections, especially from local governments rather than the central government, largely decreases the inducement effect of labor cost on innovation and can distort innovation activities and harm innovation efficiency in emerging markets such as China.
Wehrheim et al. (2020): JCF	Quan	How the ownership structure of corporations shapes their responses to discontinuous technological change?	/	375 firm-year observations with 24 European telecommunications operators from 2000 to 2016	Telecommunications operators with mixed ownership file approximately 70% fewer patents in relevant digital technologies compared to firms that are either fully private or in which the government owns a majority of shares.

Yan (2020): EL	Quan	Do state-owned enterprises influence technological development?	/	2700 firms for China and 9281 firms for India in 2019	A policymaker may intervene to lower the royalties of licensed technology when SOEs have higher expenditures on technology. Due to this intervention, firms may tend to imitate more than innovate.
Clò et al. (2020): RP	Quan	Whether SOEs differ from POEs in terms of technological capabilities? Whether SOEs' innovation-oriented attitude, compared to private firms, can be differently affected by the quality of government and institutions?	Institutional economic theory	706 telecom companies from 91 countries from 2007 to 2015, with 4854 firm-year observations	Government ownership per se positively correlates to patenting activity. While improvements in institutional quality are positively associated with firm-level patenting in general, such a relation is stronger under public ownership.
J. Zhang et al. (2020): TFSC	Quan	Whether regional energy-saving policies influence firm innovation behaviors?	/	2848 Chinese enterprises (including 2700 non-SOEs and 148 SOEs) in 2011	The implementation of energy-saving policies significantly inhibits firms' innovation behaviors in the region; the inhibitory effect on innovation behaviors of energy-intensive firms and non-SOEs is stronger
Genin et al. (2021): JIBS	Quan	Can state governance spur firm innovation in an emerging economy and transform SOEs from "dying dinosaurs" to "dynamic dynamos"?	Institutional theory	197 firms in the Chinese high-speed train sector from 1989 to 2015, with 1856 firm-year observations	State ownership exacerbates institutional logic dissonance at a restructured SOE, thus limiting innovation improvement from restructuration; in contrast, state affiliation mitigates firm dissonance and hence augments such improvement.
Cui et al. (2016): TFSC	Quan	How is a firm's engagement in technological innovation in Brazil, Russia, India, China and South Africa (BRICS) shaped by its organisational attributes?	Organizational ecology theory	1642 sample firms in Brazil, 3948 in China, 6061 in India, 1107 in Russia, and 603 in South Africa	In BRICS economies, firms with a higher export ratio and a higher government ownership share will have a lower probability of engaging in technological innovation.
Bu and Cuervo-Cazurra (2020): SEJ	Quan	What is the impact of informal entrepreneurship on innovation in emerging markets?	Agency theory; Imprinting theory	9,148 new ventures from 71 emerging economies between 2010 and 2016	Informally created firms engage more in imitative and less in innovative new product development; state ownership heightens informality costs and leads to less innovativeness.

Kroll and Kou (2019): II	Quan	Examines the influence of state ownership on innovation output at the firm level.	Agency theory; Institutional theory	Chinese listed firms during the period of 2003 – 2014, 1,625firms including 10,203 observations	State control of firms has a negative impact on innovation output in particular in China's Northeast region and in mid-tech sectors whereas under other circumstances it does either not matter or can even exert a positive influence.
Belloc (2014): JEI	Concept ual	SOEs' inefficiency is not due to state ownership per se, but is rather caused conditions other than ownership, to which SOEs often - though not necessarily always – relate.	/	/	Targeted measures, which are aimed at increasing managers' commitment to long-term investment strategies and at reducing corruption and political interference - albeit complex and difficult to implement can be much more (positively) impactful on long-run technical progress than the simple privatization of companies.
Jefferson and Su (2006): JCE	Quan	Studies of the impact of privatization on enterprise performance encounter difficult issues of selectionbias, endogeneity, and adjustment costs. In this paper, we analyze the performance impact of conversionon China’s SOEs taking these issues into account,	Comparative perspective	More than 20,000 large and medium-size enterprises in China.	The conversion of SOEs to shareholding enterprises contributes to overall increases in both current productivity and innovative effort. In particular, relative to unconverted SOEs, conversion leads to the use of more labor-intensive modes of production, which is associated with significant increases in returns to capital.
Li et al. (2017): JM	Quan	What determines misallocation in innovation?	/	Thirty provincial-level regions in China from 1999 to 2012.	Although an advanced financial market is beneficial to innovation efficiency in China, both the government's extensive development of transportation infrastructure and the preferential treatment given to SOEs and foreign-invested enterprises (FIEs) negatively correlate with innovation efficiency.
X. Zhang et al. (2020): CER	Quan	This paper investigates the impact of the ongoing mixed-ownership reform on the innovation activities of SOEs in China.	Agency theory	A-share listed Chinese companies in manufacturing industry in 2011–	The reform improves SOE's innovation. This effect is stronger for SOEs in monopoly industries and eastern developed region.

Cao et al. (2020): EMR	Quan	This paper investigates the innovative efficiency of SOEs in China.	Institutional theory; Agency theory	2015, 654 listed companies, and 3270 observations. A-share listed Chinese companies, 16,936 firm-year observations, including 6926 SOEs and 9996 non-SOEs, from 2007 to 2015.	The data indicate that minority SOEs are substantially more innovatively efficient than non-SOEs and majority SOEs. The relative innovative efficiency of minority SOEs is more pronounced among firms with high financial constraints.
Yu et al. (2022): AJTI	Quan	What is the impact of state ownership on technological innovation of private sector enterprises in different political and economic environments?	Institutional theory	Private holding companies listed on the China A-share market from 2012 to 2018	The study finds that state ownership can effectively promote the innovation activities of private sector enterprises; when local core officials change, state ownership can effectively hedge the impact of political uncertainty. In addition, in regions with higher levels of economic development, state ownership plays a significant role in promoting technological innovation of enterprises. In regions with lower levels of economic development, state ownership plays no significant role in promoting technological innovation of enterprises.
Tan et al. (2020): JCF	Quan	Examine the real effect of partial privatization on corporate innovation.	Agency theory	3,977 firm-year observations for 1289 non-financial Chinese listed firms, including 801 SOEs and 488 non-SOEs, over a 12-year period between 2000 and 2011	Partial privatization prospects have a positive effect on corporate innovation.

White et al. (2008): MOR	Quan	How different organizational influences – specifically, business group internal control mechanisms – induce group affiliates to emphasize employment and market innovation investments.	Institutional theory	1,038 Chinese group affiliated member firms from 246 business groups in 1998-1999	While government ownership and the government managerial mindset were negatively related to market innovation activities, group financial and cultural control systems positively affected the tendency of affiliate firms to focus on market innovation.
Lin et al. (2021): JCF	Quan	What is the impact of different forms of state ownership on corporate innovation and the moderating effects of environmental, social, and governance (ESG) practices, economic policy uncertainty (EPU), and corruption in this ownership–innovation nexus?	Agency theory; Institutional theory	2629 listed firms in China between 2007 and 2015.	SOEs controlled by the central government show the strongest innovation performance in all scenarios. In addition, private firms outperform local SOEs in terms of patent quantity in both manufacturing and nonmanufacturing sectors and in high-economic-development regions, whereas local SOEs outperform their private peers with respect to patent quality, mainly in the manufacturing sector and high-economic-development regions. Such an ownership–innovation nexus is then found to be more pronounced for firms engaging in more ESG practices, during periods of higher EPU, and when less corruption is present.
Wang et al. (2022): JMS	Quan	How can SOEs become more innovative in emerging economies where market competition emerges and state socialism remains?	Institutional logics perspective	486 publicly listed SOEs on the Shanghai and Shenzhen Stock Exchanges between 2008 and 2013	SOEs innovate more when the number of pyramidal layers between them and the state increases. In addition, the innovation-facilitating role of pyramidal ownership hinges on industry regulations and institutional development.
Beladi et al. (2022): JCF	Quan	What is the impact of early Party school education for top executives on corporate innovation?	/	1084 state-owned listed companies in China from 2003 to 2017	SOEs with top executives who get a Party school degree engage in less innovative activities with the lower number of patent application and grants.

Innovation quantity vs. quality					
Fang et al. (2017): RFS	Quan	How do institutional quality (IPR protection) and ownership type (state backing or not) jointly affect Chinese firms' innovative output?	The theory of economic development	Chinese firms between 2000 and 2011, with 5854 observations; 331 Publicly listed firms in China from 1990 to 2014	Innovation increases significantly after privatization; increase in innovation is larger in cities with high IPR protection than in cities with low IPR protection; patents of private firms are cited more often and have a greater international presence than patents of SOEs.
Jia et al. (2019): AMJ	Quan	Examine an important outcome created by agency risk—that agents pursue the quantity of innovation at the expense of novelty. Investigate how it is influenced by corporate and public governance.	Agency theory	Publicly listed Chinese SOEs from 2000 to 2012	Improved corporate governance tools, including better alignment of agents' private incentives and stronger monitoring, and high-quality public governance reduce such agency risk in SOEs. Higher-quality public governance enhances the functioning of corporate governance tools in further reducing such agency risk.
Hu et al. (2020): TFSC	Quan	What is the impact of China's carbon emission trading system (CETS) pilot policy on the quantity and quality of innovation?	Porter Hypothesis	2788 China's A-share listed firms from 2008 to 2016, with 17473 samples	CETS has a significantly positive effect on the quantity and quality of innovation. The CETS only promotes the innovation quantity and high-quality innovation of SOEs, large-size firms and eastern-section firms.
Lazzarini et al. (2021): JIBS	Quan	Examine the relative merits of state and private ownership on firm invention output in emerging as well as developed economies.	Agency theory	521 private and SOEs spanning 43 countries and 22 industries from 1997 to 2012	Given relatively higher levels of managerial autonomy, SOEs may outperform POEs in some types of inventive output, e.g., quantity of patents. National contexts lacking political constraints reduce SOE managers' capacity to invent.
Types of Innovation					
Weinstein and Obloj (2002): IJHRM	Quan	How are strategic and environmental variables related to the adoption of human resource innovations?	/	303 state-owned, domestic private and foreign-owned Polish firms	Business strategies, local labor markets and foreign competition are related to firm-level HRM practices. SOEs are less likely to adopt HRM innovations than are privatized firms.
Gershman et al. (2019): II	Quan and Qua	This paper studies open innovation practices in Russian SOEs.	/	6518 large Russian enterprises in 2014;	Russian SOEs are driving the demand for technology and mainly absorb incoming OI activities. Different to their peers, SOEs extend

				Four major Russian SOEs	their OI activities to the country's knowledge producers, such as research and technology organisations (RTOs), and leading universities.
Fu et al. (2014): AEP	Quan	This paper examines the determinants of open innovation as a response to the constraints and risks of innovation that firms face in emerging economies.	/	626 manufacturing firms in China over the 2005–07 period	Institutional, financial and knowledge/skills-related risks and constraints are all significantly associated with these firms' depth and breadth of openness in innovation. The responses, however; vary across firms of different ownership types. State-owned firms appear to be least responsive in use of open innovation.
Shen et al. (2019): JMTM	Quan	The purpose of this paper is to investigate the proper matches between institutional business ties (to SOEs and to banks) and firm capabilities (technological capability and marketing capability) in impacting the radical innovation of manufacturing firms in China.	Resource management model	208 manufacturing firms in China	Ties to SOEs and ties to banks are positively related to radical innovation of manufacturing firms in China. Further, the technological capability and marketing capability have different functions on moderating the relationship between institutional business ties and radical innovation.
Bai et al. (2019): JCP	Quan	This paper explores the impacts of government R&D subsidies on the green innovation of energy-intensive firms.	/	527 Chinese energy-intensive listed companies from 2010 to 2015.	Government R&D subsidies increase the green innovation of energy-intensive firms. The impact is stronger in SOEs and in small and medium enterprises.
Liu et al. (2020): JCP	Quan	Does a subsidized enterprise prefer nongreen or green innovation?	Institutional logic theory	175 publicly traded firms in the pharmaceutical industry in China from 2010-2015	The positive effect of subsidies on nongreen innovation is greater than that on green innovation due to the double-spillover problem that is pertinent to green innovation. Further, this paper argues that innovation intensity varies from privately-owned enterprises to local and central SOEs.
Liu et al. (2021): JCP	Quan	This study investigates the impact of China's new Environmental Protection Law on the green	Institutional theory	247 high-polluting firms listed in Shanghai and	Firms tend to file more applications for environmental patents, including patents for inventions and utility models after the

		innovation behaviour of listed companies in high-polluting industries.		Shenzhen Stock Exchanges from 2010 to 2017	implementation of the new Environmental Protection Law. Further analysis shows that while this effect is stronger for SOEs, it is weaker for firms headquartered in cities where economies depend more on the secondary industry.
Roud and Thurner (2018): JIE	Quan	Whether government intervention can really trigger the necessary investments into green technologies and production methods.	/	2212 Russian Manufacturing Firms	State ownership does indeed have an influence on both the likelihood to eco-innovate and on the levels of spending. Eco-innovative state-owned companies are only prone to invest in eco-innovations, if they get additional money.
Wang and Jiang (2021): JCP	Quan	Investigates how state ownership affects green innovation within a given institutional environment and in combination with firm characteristics.	Institutional theory; Resource-based view	2260 Chinese firms listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange from 2008 through 2016	State ownership positively affects a firm's green innovation. Moreover, the facilitating role of state ownership in green innovation is strengthened in regions with advanced legal development, for firms with sufficient resources, or when a board chair possesses functional experience.
Jiao et al. (2015): TFSC	Quan	How do local legal environment (LLE) and government effectiveness (GE) promote a firm's level of innovation? Does the proportion of government-owned shares have a moderating effect on these relationships?	/	Chinese firms	Both LLE and GE have significantly positive effects on firms' product, technological, process and management innovation. State ownership positively moderates the relationship between LLE and technological innovation, while negatively moderates the relationship between LLE and management innovation. It also negatively moderates the relationship between GE and management innovation.
Gao et al. (2015): JBR	Quan	Identify distinctive effects of formal and informal institutional capital on firms' radical innovation and address how effects can be influenced by multi-level contexts.	Institutional theory	560 questionnaires from 280 firms in the Chinese high-tech sector in 2011	Firms' informal institutional capital has a higher positive effect on firms' radical innovation than formal institutional capital does. The effects of firms' formal institutional capital on radical innovation would be higher in the complex market and for SOEs.

Pan et al. (2020): BSE	Quan	Investigates the role of state ownership in green innovation from the institutional complexity viewpoint.	Institutional theory	1,859 Chinese firms listed on the Shanghai or Shenzhen stock exchanges between 2003 and 2015, with 8,710 observations	Suggest a U-shaped curvilinear relationship between state ownership and green innovation; This U-shaped relationship is more pronounced when regional innovation readiness and industrial competition are higher.
Rodríguez-Pose and Zhang (2020): TFSC	Quan	To what extent does local government quality affect firm-level innovation? Does local institutional quality play a greater or lower role than both firm-specific characteristics and other local social and economic traits for innovation?	/	2,596 Chinese POEs and 104 SOEs in 2011	A low institutional quality particularly weakens the propensity of process innovation, while product innovation is less affected by poor government institutions. The cost of weak institutions for innovation is higher for private than for state-owned firms, at least in the early stages of innovation.
Usman et al. (2020): EL	Quan	How does a nationally diverse board affect a firm's inclination towards green innovation?	Human capital theory; Resource dependence theory; Upper echelons theory; Resource-based view	Manufacturing companies listed on the Shenzhen and Shanghai Stock Exchanges between 2005 and 2015, with 11250 firm-year observations	Board internationalization strengthens the tendency of firms towards green business practices. Further, SOEs have a stronger aptitude to capitalize on the presence of foreign directors on the board when compared with non-SOEs.
Hu et al. (2021): JEM	Quan	Do (and to what extent) Environmental Non-Governmental Organizations (ENGOs) influence polluting firms' green behaviors and what is the important role of geographic distance in this relationship?	Economic geography; Institutional theory	850 Chinese heavy-polluting firms listed in the Shanghai and Shenzhen Stock Exchanges between 2009 and 2015, with 5016 firm-year observations	A firm's geographic proximity to ENGOs affects green technology innovation positively and significantly; This positive relationship is stronger in SOEs than in non-SOEs; In turn, the positive relation between geographic distance beyond a 100 km radius and green management innovation is stronger in non-SOEs than in SOEs.

Zhang et al. (2021): JBE	Quan	How does entrepreneurial orientation of CEOs affect corporate philanthropy and CSR innovation at the same time?	Upper echelon theory; Attention-based view	2018 survey of 166 CEOs in China; listed Chinese firms between 2003 and 2017, with 133 firm-year observations	CEO entrepreneurial orientation leads to more engagement in CSR innovation rather than corporate philanthropy; CEOs with entrepreneurial orientation in SOEs will more likely choose corporate philanthropy over CSR innovation.

Note: Journal of Corporate Finance (JCF); Journal of Cleaner Production (JCP); Journal of Business Ethics (JBE); Journal of International Business Studies (JIBS); Technological Forecasting and Social Change (TFSC); Academy of Management Journal (AMJ); Asia Pacific Journal of Management (APJM); Industry and Innovation (II); Journal of Environmental Management (JEM); Regional Studies (RS); Research Policy (RP); Asian Economic Papers (AEP); Asian Journal of Technology Innovation (AJTI); Business Strategy and the Environment (BSE); China Economic Review (CER); Emerging Markets Review (EMR); European Journal of Finance (EJF); Industrial Marketing Management (IMM); International Journal of Research in Marketing (IJRM); International Review of Financial Analysis (IRFA); Journal of Business Research (JBR); Journal of Comparative Economics (JCE); Journal of Economic Issues (JEI); Journal of Industrial Ecology (JIE); Journal of International Money and Finance (JIMF); Journal of Macroeconomics (JM); Journal of Manufacturing Technology Management (JMTM); Journal of World Business (JWB); Management and Organization Review (MOR); Review of Financial Studies (RFS); Strategic Entrepreneurship Journal (SEJ); The World Bank Economic Review (WBER); Energy Economics (EE); Economics Letters (EL); The International Journal of Human Resource Management (IJHRM); Journal of Management Studies (JMS).

Table 2.8 Key Empirical Studies on State Ownership and Innovation Investment & Outcomes

Author: Journal	Method	Research question	Theory	Sample	Main findings
Zhou et al. (2017): ASQ	Quan	Whether state ownership benefits or impedes firm's innovation?	Institutional theory; Agency theory	12,288 Chinese manufacturing firms between 2002 and 2007, with 73,728 observations; 827 Chinese publicly listed manufacturing firms on the Shanghai or Shenzhen Stock Exchanges between 2007 and 2010, with 3,308 observations	State ownership in an emerging economy enables a firm to obtain crucial R&D resources but makes the firm less efficient in using those resources to generate innovation, and a minority state ownership is an optimal structure for innovation development in this context. Moreover, the inefficiency of state ownership in transforming R&D input into innovation output decreases when industrial competition is high, as well as for start-up firms.
Wen et al. (2018): EJF	Quan	Does stock liquidity in China's capital market influence enterprise technological innovation? Does enterprise nature of SOEs and non-SOEs moderate this relationship?	/	6194 observations for 1058 listed Chinese companies between 2006 and 2013	An increase in stock liquidity raises the number of patents granted, R&D investment, and the innovation efficiency of SOEs, while it decreases innovation significantly in private firms.
Shi et al. (2020): MOR	Quan	To what extent do innovation strategies vary among the types of Chinese firms (i.e., SOEs, foreign-funded ownership [FFO] of firms, Hong Kong-Macau Taiwanese [HMT] companies and POEs) depending on the form of market competition?	/	341,898 Chinese industrial enterprises between 2005 and 2007	SOEs tend to be more active in making innovative decisions and pursuing innovative investments but are less efficient in terms of innovation output and labor productivity, whereas FFO firms have relatively high labor productivity but are less active in the first three stages of the innovation–productivity chain. Market competition favors SOEs in the production of additional innovation products. Foreign firms are efficient in labor productivity if they are operating in a concentrated market.

Sun et al. (2021): JIBS	Quan	If and how state ownership makes a difference in shaping innovation activities (innovation inputs and outputs) within foreign-host-state JVs in comparison with their foreign-private peers?	Transaction cost economics; Agency theory	3775 IJVs with 14,757 IJV-year observations in the Chinese manufacturing sector between 2008 and 2013	More R&D investment (innovation inputs) made in IJVs with state partners than in those with private ones. This result is mitigated when foreign parents directly transfer home country-based technology to IJVs, when the host-market dependence of IJV is weak, and when IJVs are located in a deregulated region. However, foreign-host state JVs deliver fewer innovation outputs (measured by patent data) than foreign-private JVs.

Note: Administrative Science Quarterly (ASQ); European Journal of Finance (EJF); Management and Organization Review (MOR); Journal of International Business Studies (JIBS)

2.5.5 Contingency factors

Certain environmental conditions and organizational factors serve as contingencies on the effects of state ownership on innovation. Environmental conditions can be broadly classified into regional or national differences, institutional environments, and industrial competition. Studies usually agree that well-developed institutional environments, such as a high level of marketization (Yi et al., 2017), regional legal development (Wang & Jiang, 2021), national political constraints (Lazzarini et al., 2021), and national institutional quality (Clò et al., 2020), can promote SOEs' innovation. Zhou et al. (2017) examined the mitigating role of industrial competition in negative effect of state ownership on innovation efficiency. In addition, Kroll and Kou (2019) posited that SOEs can obtain stronger support to conduct innovation in innovative regions, and Yu et al. (2022) suggested a more significant impact of state ownership on innovation in regions with high levels of economic development.

Some studies have also investigated certain organizational factors as boundary conditions, including firm characteristics and process, and TMT characteristics. For instance, high-commitment HRM practices weaken the negative effect of state ownership on entrepreneurial orientation and thus improve innovation capability (Chang et al., 2019). State start-ups can be more innovative than established SOEs (Zhou et al., 2017). Minority SOEs will be more innovatively efficient in the presence of high levels of financial constraints (Cao et al., 2020). Addtionally, Wang and Jiang (2021) pointed out that the positive impact of state ownership on green innovation can be strengthened by the board chair's functional experience and when the firm has more resources.

2.6 Research Gaps and Future Research Avenues

Based on a systematic review of the existing literature, this study has identified several key research gaps that need to be addressed in the future. Accordingly, this study provides suggestions for future research, as shown in Table 2.9.

2.6.1 Lack of focus on heterogeneities of SOEs' leadership

This review has underscored that the existing literature pays most attention to firm-level and macro-level (i.e., industry-, region-, and nation-level) analyses, mainly drawing from meso- or macro-level theories, such as agency theory and institutional theory (e.g., Yi et al., 2017; Zhou et al., 2017). However, there is a paucity of micro-level research, especially on SOE leadership heterogeneity. Prior studies mostly assume that SOE leaders (e.g., CEOs) are homogenous in how they filter/process information from their internal and external environment, behave, and make decisions. Nevertheless, since Hambrick and Mason (1984)'s seminal work, studies have increasingly claimed that certain characteristics of top managers can significantly influence how they interpret their environment and make strategic decisions in the organization (for a review, see Bromiley & Rau, 2015). Echoing this point, a recent innovation review has also highlighted the significant role of strategic leadership (e.g., managers, executives or top management teams) in understanding micro-level processes within firms' innovation decision-making processes and innovation outcomes (Kurzhals et al., 2020). In addition, this study also believes SOE leadership research could help existing SOEs and innovation research address the inconclusive debates on why some SOEs are more innovative than other SOEs or private firms. Although a few studies have started to focus on how the factors related to leadership influence innovation and examine the heterogeneities between SOEs and non-SOEs, such as managerial foreign experience (Yuan & Wen, 2018), independent directors (Fu, 2019), and CEO entrepreneurial orientation (Zhang et al., 2021), they treat

SOEs as contingencies rather than focusing on the micro-level process within SOEs' decision making. Therefore, we know little about the decision processes through which SOEs configure their innovation strategies in order to serve their social goals, political goals, and economic goals. To open the 'black box' of innovation decision-making processes and thus better explain deviations and variations between SOEs and non-SOEs or between SOEs, I suggest explicitly examining SOE leadership heterogeneity within SOEs.

In this regard, micro-level research that explores SOE leaders' psychological/cognition (e.g., emotions, personalities) or demographic characteristics (e.g., status, education, working experience, and networks) is warranted (Georgakakis et al., 2022). With the microfoundation perspective, one key assumption is *bounded rationality*, which refers to decision makers' limited ability to obtain and process complete information when forming strategic choices (Hambrick & Mason, 1984). Under such an assumption, future studies can investigate questions on how SOE leaders' psychological and demographic characteristics inhibit or enable their innovation. This can be done by adopting upper echelon theory or other theories from the strategic leadership literature or behavioural theories, such as attention-based view, behavioural theory of the firm, social identity theory, or stewardship theory (Kurzhals et al., 2020). It would be interesting to explore how SOE's strategic leadership is the key to differentiating SOE from non-SOE performance, and even the performance among SOEs (Teodorovicz et al., 2022). Research can draw on the HRM practices literature and investigate whether and how HRM practices can explain innovation differences between SOEs and non-SOEs or even within SOEs. In addition, SOE managers can be both politicians/bureaucrats and businessmen (Hu & Xu, 2021; Zhou et al., 2017), and the identity preference may affect their innovation strategies. Thus, it should be interesting and important to investigate what

factors or personal characteristics influence SOE managers' preferences to be politicians or businessmen, and how such preferences affect their decision making and firm innovation.

In addition to studying top executives independently, it would be intriguing to see how the dynamics/interdependencies within the boardroom shape SOEs' innovation strategies and outcomes, particularly because strategic decision making is a collective process characterized by micro-level interactions between the CEO and other top managers (Georgakakis et al., 2022 for a review). Future research can study how the interactions between the CEO and other TMTs (e.g., power relations, leadership style conflicts, pay disparity, and pay tournaments) affect the formulation and implementation of the CEO's innovation decisions in the SOE. Given the specific nature of SOE boardrooms, where government or other non-market stakeholders influence strategic decision making, future studies could investigate how the interactions between professional executives and non-market board members shape SOEs' innovation strategies and outcomes. Overall, research on SOE leadership heterogeneity has been underrepresented in SOE and innovation research. The focus on leadership analysis can reveal the so far unobserved dialogues, debates and tensions that will help reconcile the inconclusive findings in the literature and advance our knowledge of how SOE leaders make decisions. Such findings would also have significant policy implications on hiring and developing SOE leaders.

2.6.2 Lack of focus on heterogeneities among SOEs

As mentioned above, most prior studies document well the differences between SOEs and non-SOEs and discuss how such differences distinctively shape their innovation strategies and/or outcomes (e.g., Clò et al., 2020; Lazzarini et al., 2021; Sun et al., 2021; Yi et al., 2017; Zhou et al., 2017). The review reveals only limited efforts beyond this SOE vs non-

SOEs dichotomy to identify heterogeneities among SOEs. Specifically, most studies assume that all SOEs homogeneously obey government pressures, form similar innovation strategies, and achieve similar innovation outcomes (Lazzarini et al., 2021; Sun et al., 2021; Yi et al., 2017). Although differentiating SOEs from non-SOEs is important, there are several reasons for paying greater attention to heterogeneities among SOEs. Firstly, the SOE literature must not only be able to distinguish SOEs from non-SOEs but must also be able to explain heterogeneities among SOEs. Accepting the uniqueness of SOEs is one step towards understanding SOE-related phenomena, and scholars in this field seem ready to further explore variances among SOEs. For example, a few studies compare minority SOEs with majority SOEs and evaluate their different impacts on innovation outcomes (Poczter, 2017; Wehrheim et al., 2020; Zhou et al., 2017). Such an approach will enhance our knowledge of important SOE-related phenomena around the world, especially in the post-COVID context where government is deemed to be more important in addressing grand challenges. Second, as mentioned above, empirical research has produced inconsistent and conflicting relationships between state ownership and innovation. It is likely that the problem partially stems from measurement, sample context, and analysis. However, this is ultimately a theoretical issue that guides empirical analysis and requires further theoretical reconciliation. Although existing literature has begun to introduce moderators to resolve the inconclusive findings (Kroll & Kou, 2019; Yi et al., 2017; Zhou et al., 2017), I argue that an alternative and effective way to address such inconclusive findings could be to shift the focus to heterogeneities within SOEs rather than dichotomizing SOEs against non-SOEs. SOEs are different in many aspects, such as ownership structure, goals, resources endowment, and leadership, which may result in different innovation strategies and outcomes among SOEs. As a result, an elaborate examination of the heterogeneity among SOEs can further provide opportunities

to address the inconsistencies in previous studies and make robust theoretical contributions to the field.

There are some potential research questions worth pursuing in future research. For example, scholars could compare and see whether the variances in innovation strategies and innovation performance among SOEs are as large as, if not larger than, the variations between SOEs and non-SOEs. This can provide solid evidence for shifting the focus to the variances among SOEs. In addition, unlocking sources of innovation heterogeneities among SOEs is also promising for future research. Potential causes of heterogeneity among SOEs might include governance structure (e.g., SOEs controlled by central government vs local government), resource endowment (e.g., high resource support from government vs low resource support), and leadership (e.g., CEO with political connections/political career). For example, a few scholars have suggested that firms affiliated with different levels of government within a country behave differently regarding foreign location choice (Li, Meyer, et al., 2018) and innovation performance (Li, Xia, et al., 2018a). This can inform SOE heterogeneities research and explore how the affiliation to different levels of government explains the innovation variances among SOEs. Relatedly, since SOEs are normally governed/monitored by politicians, future studies could also investigate how certain characteristics of politicians (e.g., political goals, career stage, working experience) within SOEs influence their innovation differently. We know little about the political agents' impact on SOEs' innovation. Furthermore, building on the point of investigating micro-level factors above, it would be interesting to investigate another important source of heterogeneity: SOE leadership characteristics. Overall, we need more focus on heterogeneities within SOEs to address inconsistent relationships and enrich our understanding of SOE phenomena.

2.6.3 Lack of focus on heterogeneities of innovation

Previous literature largely discusses the role of state ownership in innovation in a general sense, and only very few studies have paid attention to certain types of innovation, such as product vs process innovation (Poczter, 2017), radical innovation (Gao et al., 2015), and green innovation (Wang & Jiang, 2021), as summarized above. Innovation is inherently a multi-aspect concept, which can be categorized by form of innovation (e.g., product/service/process/business model innovation), magnitude of innovation (e.g., incremental vs radical innovation), or reference point (e.g., industry peers, the firm itself, market, country) (Crossan & Apaydin, 2010). Given these different kinds of innovation, as a starting point, I suggest future research should pay more attention to exploring whether SOEs behave differently from non-SOEs or other SOEs in terms of different aspects of innovation. The shift in focus towards the complex nature and heterogeneities of innovation has further advantages. It will resolve inconsistent prior findings and significantly expand our currently limited understanding of SOE innovation by providing more targeted/elaborate findings. For example, SOEs with resource endowments, legitimacy, and a long-term perspective could more easily absorb formal institutional capital for radical innovation (Gao et al., 2015). Poczter (2017) posits that firms with minority state ownership tend to conduct more process innovation than product innovation, especially under financial constraints.

Another interesting question could be: How do SOEs address grand challenges (e.g., climate change, inequality) through innovation (e.g., social innovation, green innovation)? What are the enablers or inhibitors of conducting such innovation within SOEs? According to the review, the literature on SOEs' social-related innovation is still in its infancy, and it has much potential. On the one hand, government and businesses are undoubtedly main players in addressing global grand challenges, such as climate change,

health and well-being, and poverty and inequalities (George et al., 2016). On the other hand, as the defining feature of SOEs is their primary social-oriented goals mixed with economic goals (Musacchio et al., 2015), it is both relevant and interesting to ask how SOEs tackle pressing grand challenges through different kinds of innovation. For instance, climate change has become increasingly serious and has attracted rising attention from various scholars, practitioners, and the public (Nyberg et al., 2022). As SOEs account for a large proportion of heavily polluting industries (e.g., petroleum and chemical industries) (Maung et al., 2016), it is reasonable to assume that all SOEs should champion the development of green innovation and a low-carbon economy. Although green innovation has been an emerging topic in the current literature (Liu et al., 2020; Pan et al., 2020; Wang & Jiang, 2021), we still have limited knowledge on whether SOEs have more advantages than other enterprises in conducting green innovation, and what the enablers or inhibitors for SOEs green innovation are. Unpacking the 'recipes' for incentivizing SOEs' social-related innovation will generate impactful research that can benefit SOEs in developing strategies for mitigating societal challenges in the future, as well as benefit society at large.

2.6.4 Lack of focus on heterogeneities of research contexts

As shown in Table 2.3, most of the existing studies used a large and important emerging economy, China, as the research context (e,g, Fang et al., 2017; Genin et al., 2021; Jia et al., 2019; Zhou et al., 2017). Only a few studies have paid attention to the contexts of multiple countries (Clò et al., 2020; Lazzarini et al., 2021), Europe (Wehrheim et al., 2020), or other specific countries, such as Russia (Gershman et al., 2019) and Estonia (Tõnurist, 2015). However, although SOEs have by now similar management structures, popularized by the OECD, their activities and roles in different countries can differ significantly depending on macro-level factors (Tõnurist & Karo, 2016). For instance,

SOEs were used as a fast track to industrialization in Brazil (Musacchio & Lazzarini, 2014), while in China, SOEs are used to maintain control over and develop strategic industries (Chan & Rosenbloom, 2010). In Finland and Sweden, the governments have taken a perspective of value creation and 'active' ownership of SOEs based on deregulation and strong strategic choices (Clifton et al., 2006). Musacchio et al. (2015) theoretically analyzed the influence of country-level institutional conditions on the firm performance of different types of SOEs. Belloc (2014) also pointed out that the inefficiency of SOEs stems from various sources based on two types of government, benevolent government or malevolent government. Therefore, future research should study SOE innovation in different countries other than China. It would be interesting to compare the variances of SOEs' innovation between emerging economies and developed countries, which would help us further understand the role of SOEs in innovation.

2.6.5 Lack of causal inference studies related to SOE innovation

Endogeneity issues, possibly caused by omitted variable bias, selection bias, simultaneous causality, dynamic panel bias, or measurement error, have always been persisting in SOE innovation research. Accounting for endogeneity is essential to gain a grasp of the causal mechanisms lying behind empirical associations in research on SOE innovation. Scholars have tried to adopt different approaches to address endogeneity issues, such as two-stage least square (2SLS) models, propensity score matching (PSM) techniques and Heckman two-stage approach. For example, Zhou et al. (2017) used PSM techniques to generate a sample of comparable SOEs and privately owned firms when examining the effect of state ownership on innovation. Using instrumental variables is a key method to mitigate endogeneity concern. Sun et al. (2021) adopted 2SLS models to use the instrumental variables, estimating the relationships between host-country state ownership and R&D investments and innovation output in international joint ventures.

Similarly, employing an efficient instrumental variable estimator via the two-step GMM approach, Yi et al. (2017) estimated the relationship between state ownership and innovation performance. Furthermore, Lin et al. (2021) employed Heckman two-stage approach to address the self-selection bias problem. Considering the importance to uncover the causal mechanisms related to SOE innovation, future research should pay more attention to adopt various advanced methods (e.g., quasi-experiment) to mitigate the possible endogeneity issues.

Table 2.9 Research Gaps and Future Research Avenues

	Research gap	Possible research questions
1	Lack of focus on heterogeneities of SOEs' leadership	How do SOE leaders' psychological and demographic characteristics enable or inhibit SOEs' innovation? What factors or personal characteristics can influence SOE managers' preferences to be politicians or businessmen? How does this preference affect decision making and firm innovation? How does the interaction between CEO and other TMTs (e.g., power relations, leadership style conflicts, pay disparity, and pay tournaments) affect the formulation and implementation of the CEO's innovation decisions in an SOE? How does the interaction (e.g., goal incongruence, career horizons) between professional executives and non-market board members (e.g., government officials or agencies) determine SOEs' innovation strategies and outcomes?
2	Lack of focus on heterogeneities among SOEs	Are variations in innovation strategy and outcome among SOEs larger than the variations between SOEs and non-SOEs? What and how do sources of heterogeneities (e.g., governance-related, resource-related, and leadership-related heterogeneities) increase/reduce innovation variances among SOEs?
3	Lack of focus on heterogeneities of innovation	Do SOEs behave differently from non-SOEs or other SOEs in terms of different types of innovation (e.g., radical vs incremental innovation, product/service vs process innovation, newness to industry vs. to market vs. to country)? How do SOEs address grand challenges (e.g., climate change, inequality) through certain types of innovation (e.g., social innovation, green innovation)? What are enablers or inhibitors for SOEs to conduct such innovation?
4	Lack of focus on heterogeneities of research contexts	What are the variances of SOE innovation between emerging economies and developed countries?
5	Lack of causal inference studies related to SOE innovation	What are the causal mechanisms behind SOEs and innovation?

2.7 Conclusions

In recent years, the role of state ownership in innovation has received increasing attention from scholars across various disciplines. Nevertheless, existing literature on state ownership and innovation has been criticized for being diverse and fragmented, limiting our understanding. To date, no systematic overview of this topic has been published to integrate existing studies. Therefore, to promote a clear and comprehensive understanding of the topic, I conducted a systematic literature review of previous literature, by combining the bibliometric coupling tool with a content analysis approach, and identified several research gaps for a future research agenda.

I used the keywords 'state ownership' and 'innovation' to systematically search for related articles in the Web of Science database. After the identification and screening process, my final sample comprised 187 papers for the systematic review, and through the bibliometric coupling method, 107 papers were selected in the coupling map and divided into four distinct clusters. Then, based on the bibliometric results, I conducted a content analysis of the existing articles and developed an integrative framework to synthesize their main findings.

Finally, I identified several research gaps through the review and have provided suggestions for future research. First, I propose that scholars should discover the heterogeneity of SOE leadership. Second, I highlight the importance of going beyond the difference between SOEs and non-SOEs and further examining various heterogeneities among SOEs, such as ownership structure and firm resources. Third, I call for more focus on the complex nature of innovation and invite researchers to pay more dedicated attention to SOEs' specific innovation types, such as radical innovation and social-related innovation. Next, I suggest that scholars could conduct future research using different or multiple countries as research contexts, except China, which has already been quite

widely researched. Lastly, future research should improve the research methods to investigate causal mechanisms related to SOE innovation.

3. Study Two: Conflicting Institutional Logics and Innovation: The Impact of CEOs' Private Firm Experience in State-Owned Enterprises

3.1 Introduction

Organizations function in a complex institutional environment such that managers often face conflicting institutional logics (Greenwood et al., 2011; Kraatz & Block, 2008; Pache & Santos, 2010; Reay & Hinings, 2009). Institutional logics (interchangeably used as 'logics'), defined as the "socially constructed historical patterns of material practices, assumptions, values, beliefs and rules" (Thornton & Ocasio, 1999, p. 804), provide guidelines for individual and organizational actions (Friedland & Alford, 1991; Thornton et al., 2012). Management scholars have examined conflicting institutional logics in various settings, such as biotechnological companies (Murray, 2010), social enterprises (Pache & Santos, 2012), community banks (Almandoz, 2012, 2014), health-care organizations (Reay & Hinings, 2009), and medical education (Dunn & Jones, 2010). Further, some studies have explored the effects of conflicting logics on firms' practices and outcomes, such as mergers and acquisitions (M&As) (Greve & Zhang, 2017), strategic entrepreneurship (Yiu et al., 2014), risk exposure (Almandoz, 2014), and bank performance (Boone et al., 2022).

An important factor determining an organization's strategic direction is the degree to which institutional logics are represented by individuals within the organization (Fiss & Zajac, 2004; Pache & Santos, 2010). An emerging stream of studies has highlighted the role of individuals, especially decision makers, in interpreting and managing multiple, and often conflicting logics (Besharov & Smith, 2014; Mangen & Brivot, 2014; Pache et al., 2024; Smith & Besharov, 2017) and examined different organizational outcomes

(Almandoz, 2012, 2014; Boone et al., 2022; Greve & Zhang, 2017). Yet, these studies largely focus on how an individual executive represents one dominant institutional logics and how this affects firm outcomes, but they ignore that an individual executive, such as the chief executive officer (CEO), may be embedded in and enact multiple conflicting logics simultaneously. We know little about how the logic conflicts influence individual executive's (e.g., CEO's) behavior and affect firm outcomes. Notably, the logic that the CEO has been previously socialized into may conflict with the logic dominant in the current firm. This is because CEOs promote certain assumptions and values that they have been trained to follow through socialization in prior professional contexts, thereby becoming the "carrier" of a certain institutional logic, which shapes their cognitive interpretations of the environment and guides their behaviors and decisions in their current firms (Almandoz, 2014; Boone et al., 2022; Pache & Santos, 2010). At the same time, a potentially conflicting logic dominant in the current focal firm also shapes CEOs' cognitions and actions in their firms (Thornton & Ocasio, 2008), leading to the coexistence of conflicting logics experienced by the CEO.

The phenomenon where an individual executive is embedded in two conflicting logics is common in the real world. For example, the logic carried by home country executives may be different from the logic of a foreign subsidiary they lead (Campagnolo & Vincenti, 2022), and these conflicting logics experienced by top managers often translate into substantial integration-related challenges in international assignments (Meyer et al., 2020; Peltokorpi & Zhang, 2020). We rarely know about the effects of individual executives' embeddedness in conflicting logics on their actions and decisions and firm outcomes, which limits our understanding of the complex role of individuals in enacting and responding to conflicting institutional logics. Therefore, it is relevant, both theoretically and practically, to understand how individuals, such as the CEO, embedded

in conflicting logics stemming from prior and current experiences in different firm contexts, influence firm outcomes—a question that remains underexplored. In particular, I ask: When the CEO is embedded in conflicting logics acquired through prior and current experiences in different firm contexts, how does that affect firm innovation performance? I examine this question in the specific context of CEOs of Chinese state-owned enterprises (SOEs) who had prior private firm experience. My aim is to see whether and how the CEOs' embeddedness in the conflicting market capitalism logic (hereafter 'market logic'), obtained through previous work experience in private firms, and state socialism logic (hereafter 'state logic'), dominant in the current SOE they serve, affects the SOEs' innovation performance. I further seek to determine what conditions can moderate such an impact.

This is an ideal research context because market reforms in China since the 1980s have resulted in the coexistence of state logic, which highlights social and political goals pursued through state control and redistribution of resources, and market logic, which emphasizes competition, efficiency, innovation, and profit maximization (Genin et al., 2021; Greve & Zhang, 2017; Wang et al., 2022). The privatization of SOEs causes the formation of partially privatized firms and the entry of private firms with no state ownership (Musacchio et al., 2015). Being owned and controlled by the government (OECD, 2017), SOEs are embedded in a state logic, and although the state may own less than the majority of a firm's shareholdings in many partially privatized SOEs, the state logic can still exert a dominant influence (Genin et al., 2021; Wang et al., 2022). In contrast, private firms with no state ownership are mainly embedded in the market logic. Thus, top managers (e.g., CEOs) with diverse professional experiences are inevitably exposed to both market logic and state logic. The research period of this study spans from 2008 to 2016, capturing a major period of China's institutional transition from state to

market logic. Therefore, the research context of Chinese SOEs provides a great opportunity to examine CEOs' exposure to conflicting logics (i.e., state logic vs market logic) when the CEO has private firm experience. Moreover, considering the pivotal role of innovation in sustaining a firm's competitive advantage and in national economic development (Crossan & Apaydin, 2010; Romer, 1990; Solow, 1957) and the presence of large innovation variances among SOEs (e.g., Jia et al., 2019), it is valuable to examine the puzzle through a nascent lens of conflicting institutional logics.

The institutional logics perspective (Friedland & Alford, 1991; Thornton et al., 2012) suggests that goals and values embedded within institutional logics shape individuals' cognitive structures and guide their decisions (Lounsbury, 2007; Thornton et al., 2012). Building on this idea, I suggest that an SOE's CEO with previous private firm experience is exposed to conflicting market and state logics with different goals and values, which would have a distinctive effect on the CEO's cognition with regard to innovation. I expect the CEO who is exposed to conflicting logics, to experience cognitive dissonance (Festinger, 1957; Morven & O'Connor, 2017), hindering the CEO's motivation and ability to conduct innovation-related decisions, thus impeding firm innovation. Based on this, I contend that the CEO's prior private firm experience may have a negative influence on an SOE's innovation performance.

Furthermore, I examine the boundaries of the impact of conflicting logics, based on factors that influence a CEO's prior exposure to conflicting logics (i.e., a CEO's international exposure) and the extent of conflict between state and market logics experienced by the CEO (i.e., level of stateness). I propose that a CEO's international exposure (captured by foreign experience) assists the CEO in effectively dealing with the cognitive dissonance associated with the market–state logic conflicts, thus attenuating the negative impact of the CEO's private firm experience on innovation. However, the level

of stateness (manifested in the level of state ownership) could intensify the CEO's cognitive dissonance associated with logic conflicts, aggravating the negative relationship between the CEO's private firm experience and the SOE's innovation performance. I find empirical evidence supporting my hypotheses through a sample of 1,571 publicly listed Chinese SOEs from 2008 to 2016.

I make three main contributions to the literature on institutional logics, upper echelons, and SOEs—and their impact on innovation. First, I contribute to the institutional logics perspective by showing how the individual leader exposed to conflicting institutional logics affects organizational outcomes. Existing literature has shown the role of individuals' representation of the institutional logic in organizational practices and outcomes (e.g., Almandoz, 2014; Besharov & Smith, 2014; Mangen & Brivot, 2014; Pache et al., 2024). However, scholars often assume that one individual only espouses one particular logic that conflicts with others, with limited focus on a complex and common scenario in which an individual is embedded in two conflicting logics due to their socialization in different prior and current professional contexts (Almandoz, 2014; Boone et al., 2022; Pache & Santos, 2010). We know little about how embeddedness in conflicting logics impacts individual behavior and firm outcomes. My study provides strong empirical evidence of the negative consequences of conflicting logics—market and state—experienced by the SOE's CEO for innovation. In that way, I enrich the understanding of how the coexistence of conflicting logics within one individual shapes their actions and decisions (Thornton & Ocasio, 2008) and thereby affects organizational outcomes (Besharov & Smith, 2014; Suddaby, 2010). Thus, my study sheds light on the complex microfoundations under conflicting institutional logics, responding to calls to examine the role of individual embeddedness in multiple

institutional logics within organizations (Greenwood et al., 2017; Pache & Santos, 2010; Thornton et al., 2012), to ultimately shape firm-level outcomes.

Second, I provide a bridge between the institutional logics perspective and the upper echelons theory regarding top managers' impact on innovation performance (Bantel & Jackson, 1989; Damanpour & Schneider, 2006; Elenkov & Manev, 2005). Prior upper echelons research has typically relied on individual differences in demographics, personalities, incentives, and cognitive abilities of the CEO and top management team to explain any variance in firms' innovation performance (e.g., Galasso & Simcoe, 2011; Lin et al., 2011; Yadav et al., 2007; Zhang et al., 2017), without accounting for variances arising from logic conflicts. I show that the logic conflicts experienced by CEOs impede firm innovation. In doing so, I highlight the value of integrating institutional logics into upper echelons research to better understand the mechanisms underlying how top managers' characteristics improve or inhibit firm innovation.

Last, I contribute to SOE literature by introducing the aspect of CEO heterogeneity within SOEs. Prior studies on SOEs implicitly assumed that SOEs' CEOs are homogeneous in how they interpret the environment and make decisions, including on innovation (e.g., Zhou et al., 2017). We know little about whether and how CEOs' heterogeneities influence SOEs' innovation performance. By examining the effects of CEOs' prior private firm experience, I unveil how variance at the individual level affects SOEs' in-firm innovation performance, further advancing the SOE innovation literature.

3.2 Theoretical Background and Hypotheses Development

3.2.1 Conflicting institutional logics and individual agency

In their seminal work, Alford and Friedland (1985) used the term "institutional logics" to describe the contested practices and beliefs inherent in the institutions of capitalism, state bureaucracy, and political democracy. While there are various definitions, it is agreed that

institutional logics are "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality" (Thornton & Ocasio, 1999, p. 804). Serving as prescriptions for thought and action (Friedland & Alford, 1991), institutional logics specify which issues are prominent, what constitutes legitimate behavior, the criteria by which individuals and organizations are assessed, and personal and organizational identities and goals—all of which structure cognition and shape the decision-making of individuals (Lounsbury, 2007). Institutional logics are inherently cross-level, emphasizing the interplay of individuals with organizations and institutions (Besharov & Smith, 2014; Thornton & Ocasio, 2008).

A core research stream on institutional logics holds that organizations often face multiple and "conflicting logics" in a complex institutional environment (Greenwood et al., 2011; Pache & Santos, 2012; Thornton & Ocasio, 1999). *Conflicting logics* (or incompatible logics) refers to the extent to which logics provide inconsistent prescriptions for action, leading to tensions that organizations and their constituent individuals must manage (Ashraf et al., 2017; Besharov & Smith, 2014; Greenwood et al., 2011). Indeed, over the past two decades, management scholars have extensively studied how organizations respond to conflicting institutional logics (e.g., Greenwood et al., 2011; Kraatz & Block, 2008; Pache & Santos, 2010), from adopting a decoupling strategy (e.g., making only a ceremonial and symbolic commitment to other logics while preserving a core logic) (Kraatz & Block, 2008) to integrating conflicting logics in several ways, such as "blending logics" (Ramus et al., 2016; Tracey et al., 2010) and "selective coupling logics" (Pache & Santos, 2012).

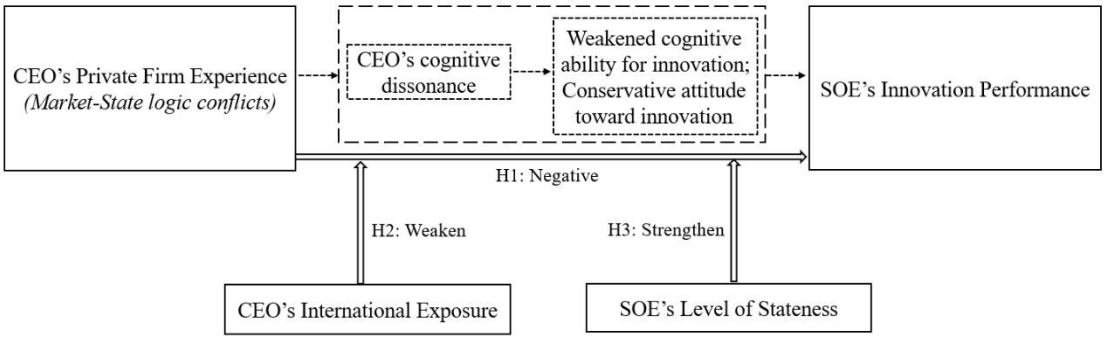
A core assumption of institutional logics is that the interests, values, and assumptions of individuals and organizations are embedded within prevailing institutional logics (i.e.,

embedded agency), and thus decisions and outcomes are a result of the interplay between individual agency and institutional structure (e.g., Friedland & Alford, 1991; Greenwood et al., 2017; Thornton & Ocasio, 1999). Notably, a stream of literature highlights the role of individual agencies in filtering and resolving conflicting institutional logics (Almandoz, 2014; Boone et al., 2022; Mangen & Brivot, 2014; Pache & Santos, 2010). Pache and Santos (2010) underscore that understanding the details of micro-level action, that is, how actors within organizations experience, assess, and manage conflicting logics, is key to explaining how organizations experience and respond to conflicting institutional demands. Besharov and Smith (2014) theorized that individual-level factors influence two dimensions of logic multiplicity within organizations (i.e., logic compatibility and logic centrality), and several studies have highlighted that organizational actors are important in sustaining organizational hybridity (Gümüsay et al., 2019; Mangen & Brivot, 2014; Pache et al., 2024; Smith & Besharov, 2017). A few studies have built on the notion that the degree to which conflicting logics are represented by individuals within the organization determines the organization's strategic practices and outcomes (Fiss & Zajac, 2004; Pache & Santos, 2010). For example, Almandoz (2012) revealed that founding teams with more directors embedded in financial logic were less likely to succeed in establishing a bank, while embeddedness in community logic encouraged founders' entrepreneurial success. Greve and Zhang (2017) claimed that the more board members are embedded in state socialism logic, the fewer market-oriented M&A decisions are made by the firm, while the directors' embeddedness in market capitalism logic leads to more M&As. Boone et al. (2022) investigated how the founding team's hybridity with conflicting logics influenced the performance of Islamic Bank branches.

Despite these insights into the individual agency of institutional logics, these studies predominantly focus on individual agency in one of the two conflicting institutional logics,

which affects organizational outcomes. We still do not know how an individual, who may be embedded in both two conflicting logics, stemming from socialization during prior and current professional contexts, reacts to the logic conflicts and ultimately affect the firm's outcomes. In this study, I build on institutional logics perspective, especially how institutional logics structure individual cognition (Lounsbury, 2007), and examine the innovation implications of an SOE's CEO with prior private firm experience, causing exposure to the conflicting logics (i.e., market logic vs. state logic).

Figure 3.1 Theoretical Framework of Study Two



3.2.2 Market capitalism logic vs state socialism logic: CEO's private firm experience and SOE innovation

As taken-for-granted practices and assumptions, institutional logics are deeply embedded in individuals' (e.g., CEOs') cognition about what is appropriate and meaningful, affecting how they perceive, pay attention to, evaluate, and respond to environmental stimuli (Almandoz, 2014; Pahnke et al., 2015). The competing goals and values underpinning market logic and state logic, which coexist in CEOs' minds via prior working experience in private firms and currently working in SOEs, can cause cognitive dissonance and, in turn, affect a firm's innovation.

Market logic is based on open markets with free competition governed by the law of supply and demand (Genin et al., 2021; Nee, 1992). Under market logic, the goal of firms is profit maximization and economic efficiency, by means of market exchange and

competition (Greve & Zhang, 2017). Innovation is widely regarded as a critical source of sustainable competitive advantage (Crossan & Apaydin, 2010; Zhou et al., 2017), and as an important determinant of firm performance (Lööf & Heshmati, 2006; Mone et al., 1998). Therefore, CEOs with market logic are likely to view maximizing profits as the firm's main purpose and give considerable weight to innovation-related considerations for enhancing the firm's financial performance and competitive advantage. Furthermore, given the normative value of being a distinctive firm guided by market logic, CEOs generally exhibit a positive stance towards risk-taking and innovation so that the firm can be perceived as a leader rather than an imitator, leading to not only economic gains but also social recognition (Gorodnichenko & Roland, 2011). Moreover, individualism is at the core of capitalistic societies, and promoting an individual's distinctiveness is a key cultural value of market logic, which inspires CEOs to be entrepreneurial and creative (Gorodnichenko & Roland, 2011; Kim et al., 1994).

In contrast, state logic is based on a redistributive economy where governmental agencies allocate and distribute inputs and outputs, aligning with their social and political objectives (Nee, 1989). The primary goal of this logic is preserving social and market stability (Nee, 1992), although pursuing this goal may impede a firm's profitability and efficiency (Megginson & Netter, 2001; Shleifer, 1998). For example, firms may retain redundant employees to maintain employment levels (Greve & Zhang, 2017). Hence, CEOs embedded in state logic are likely to focus more on social welfare and downplay a firm's innovation. Moreover, maintaining the status quo is a normative value of state logic (Nee, 1989), for the firm to remain beneficiaries in social welfare programs such as employee health care and retirement benefits (Zhou et al., 2006). This may incentivize CEOs to engage in stable and predictable actions instead of taking high risks. Finally, state logic is rooted in a collectivist culture, which highlights community welfare more

than individual interests and attempts to diminish distinctions between individuals (Hofstede & Hofstede, 2001), which is likely to weaken CEOs' belief in creative actions.

A firm's ownership structure is critical for the institutionalized importation of societal logics, such as market logic and state logic (Greenwood et al., 2011). Previous studies indicated that private firms hold market logic, which conflicts with the prevailing state logic dominant in SOEs[4] (e.g., Genin et al., 2021; Greve & Zhang, 2017; Wang et al., 2022). Therefore, through socialization during prior work experience in private firms, CEOs are exposed to a market logic, which conflicts with the state logic they experience through their current work in SOEs. The conflicting goals and values underpinning these logics are likely to face CEOs with inconsistencies in their beliefs and attitudes towards innovation. Following cognition studies (e.g., Festinger, 1957; Greenwald & Ronis, 1978; Harmon-Jones & Harmon-Jones, 2012; Hinojosa et al., 2017), I term such a situation *cognitive dissonance*, defined as a negative affective state aroused by an individual experiencing two inconsistent cognitions. Cognition is broadly defined as any mental representation such as an attitude, belief, or knowledge of one's own behavior (Festinger, 1957).

Individuals with cognitive dissonance experience psychological discomfort and stress (Ciao & Latner, 2011; Festinger, 1957), motivating them to invest substantial cognitive resources to reduce the dissonance and, therefore, depleting the cognitive ability necessary for complex innovation tasks (Halevy et al., 2012; Hinojosa et al., 2017). For instance, Kammeyer-Mueller et al. (2010) support the idea that ethical conflict as a source of cognitive dissonance is related to higher emotional exhaustion and lower career

[4] In my baseline hypothesis, it is reasonable to assume that SOEs follow a state logic, regardless of the level of state ownership, due to the powerful influence of government on firms (Wang et al., 2022). I acknowledge that government influence may vary across state ownership, so I will relax such an assumption when I discuss the moderation effect of the level of stateness, captured by state ownership.

fulfillment among early-career employers. In the context of foreign subsidiary management, Takeuchi et al. (2008) found that expatriate managers experience significant strain due to the dissonance between decision autonomy at the subsidiary and the global integration pressures exerted by the parent, ultimately associating with less effective expatriate adjustment. Similarly, Martinie et al. (2010) suggested that dissonance consumes working memory resources in a complex task, making individuals perform less efficiently. Furthermore, it has been shown that cognitive dissonance results in an individual's misperception or misinterpretation of the information, or even rejection or refutation of the information, reducing information processing abilities (Harmon-Jones & Mills, 2019).

Individuals commonly rely on two types of information processing approaches in decision-making: a) conscious and controlled processing that requires substantial cognitive ability, and b) automatic processing associated with heuristics and affect (Evans, 2003, 2008; Shiffrin & Schneider, 1984; Simons, 1947). Ample evidence has shown that individuals tend to favor fast and effortless processing systems—intuition and affect—over costly and complex conscious and controlled processing (Evans, 2007; Hodgkinson & Sadler-Smith, 2018) to conserve sparse mental resources. In the situation of cognitive dissonance that causes stress and consumes substantial cognitive resources, I expect that individuals tend to take less complex, less risky, and more conservative responses (Aronson, 1969; Dohmen et al., 2010), such as resisting innovation, especially in contexts lacking support for innovation (Rao & Mattarelli, 2023).

Taken together, I suggest that conflicting logics induce cognitive dissonance in CEOs, which results in their weakened cognitive ability for innovation. This is reflected in weakened information processing capability, inefficiency in dealing with complex tasks, and conservative attitudes towards innovation, which jointly can hinder CEOs'

ability and motivation to conduct innovation. A large number of studies has confirmed the importance of radical and active search and increased cognitive ability in driving high innovation performance (Laursen & Salter, 2006; Roper et al., 2017). Thus, I expect a CEO's private firm experience to impede SOE's innovation performance, as proposed in the following:

H1: *In an SOE, a CEO's private firm experience has a negative relationship with the SOE's innovation performance.*

3.2.3 Conflicting logics buffer: CEO's international exposure

I suggest that the extent to which the CEO's exposure to market-state logic conflicts impedes SOE's innovation depends on whether the CEO has experienced conflicting institutional logic in the past, such as through international exposure (captured by international experience). Countries differ with regard to cultures, institutional environments, economic development, and business practices (Kostova & Zaheer, 1999). When individuals study or work in foreign countries, they constantly deal with logic conflicts arising from institutional or cultural distance (Kostova et al., 2020). Such experience can enhance individuals' general cognitive competencies, including harboring multiple views, processing complex information, and being creative (Fee et al., 2013; Le & Kroll, 2017). Many studies have recognized the value of foreign experience in improving managers' cognition competencies, which facilitate firm performance and innovation (Benson et al., 2009; Fee et al., 2013; Suutari & Mäkelä, 2007).

Specifically, studying or working in foreign countries can expose CEOs to various worldviews, value systems, and ideas (Carpenter & Fredrickson, 2001), enabling them to view issues from multiple perspectives. Living in a different environment full of complexity and uncertainty, CEOs develop the ability to process complex and dynamic information (Li et al., 2012) and solve problems encountered in foreign countries, which

requires them to be creative (Leung et al., 2008). Therefore, I propose that CEOs with international exposure may have higher cognitive competencies than those without such experience, which is likely to buffer them from the negative effects of cognitive dissonance caused by conflicting market and state logics. Accordingly, I propose:

H2: *The negative relationship between a CEO's private firm experience and an SOE's innovation performance will be weakened when the CEO has international exposure.*

3.2.4 Conflicting logics catalyst: level of stateness

I further argue that the negative impact of conflicting institutional logics experienced by the CEO with private firm experience on an SOE's innovation performance will be more prominent when the SOE has a high level of stateness (captured by state ownership). SOEs differ based on their degrees of state ownership (Musacchio et al., 2015; Zhou et al., 2017). For example, studies suggest that minority SOEs differ from majority SOEs in terms of the degree of state intervention and agency issues, thus having a distinctive impact on governance efficiency (Musacchio et al., 2015; Poczter, 2017; Zhou et al., 2017). In this regard, I expect that the conflicts between the state logic dominant in SOEs and the market logic obtained through previous private firm experience, as experienced by CEOs, also differ across SOEs based on the levels of state ownership. To begin with, I assume that the degree of influence of market logic on a CEO's cognition through previous work experience in private firms will not be easily changed by the levels of state ownership because once formed, an individual's beliefs tend to be long lasting (Akerlof & Dickens, 1982). When SOEs have a high level of stateness, they are more likely to be subject to government intervention and strongly reflect the state logic (Greve & Zhang, 2017), and show more resistance to the market logic obtained by CEOs. Thus, CEOs with private firm experience will be exposed to more logic conflicts. For those CEOs who have

had their cognition shaped by market logic, they are likely to experience more intensive cognitive dissonance in SOEs with a high level of stateness because under strong state logic, their previous cognitions are more likely to be challenged, and it will be challenging for them to persuade stakeholders to accept ideas based on market logic.

However, in SOEs with low levels of stateness, the impact of the state logic can be lessened by reducing government intervention and increasing the proportion of shares owned by private shareholders, thereby inducing more acceptance of market logic and leading to less conflict between market and state logics (Greve & Zhang, 2017; Zhou et al., 2017). Thus, CEOs may experience less cognitive dissonance in these SOEs. Consequently, I propose that a higher level of stateness is likely to intensify a CEO's cognitive dissonance associated with conflicting state and market logics and, thus, aggravate the negative effects of a CEO's private firm experience on an SOE's innovation performance.

H3: *The negative relationship between a CEO's private firm experience and an SOE's innovation performance will be strengthened when the SOE has a high level of stateness.*

3.3 Research Methodology

3.3.1 Data and sample

To investigate my research question and test the hypotheses, I used a sample of Chinese SOEs listed on the Shanghai Stock Exchange (SHSE) and the Shenzhen Stock Exchange (SZSE) during the period 2008–2016. I collected firm-level financial and governance information, as well as CEO personal characteristics, from the China Stock Market & Accounting Research (CSMAR) database. Patent-related information was obtained from the China National Intellectual Property Administration (CNIPA). Finally, I obtained the data on the provincial marketization index from the National Economic Research Institute

of China (NERI). The data of provincial marketization index is available from 1999 to 2016 and the data of an important CEO personal characteristic (i.e., international experience) is available from 2008, thus my sample period is chosen between 2008 and 2016.

To construct the sample, I excluded the following observations: (1) SOEs designated as Special Treatment (ST) by the China Securities Regulatory Commission, (2) financial firms (e.g., banks, insurance companies, and investment trusts) due to their unique operating structures and financial reporting requirements compared to other firms, and (3) observations with missing values for the main variables. For the regression analysis, I employed a one-year lag for the independent variables in the models. The final sample consisted of a panel of 1,571 SOEs and 4,600 observations from 31 provinces and 19 industries, classified by one-digit Chinese industry codes.

3.3.2 Variables

Dependent variable. I measured the *innovation performance* of SOEs as the total number of patents, including invention patents, design patents, and utility model patents, that a firm applied for in a given year. Although the number of patent applications cannot fully capture a firm's innovation activity, it is widely acknowledged in the literature as an important and valid measure of a firm's innovation performance (Clò et al., 2020; Zhou et al., 2017).

Independent variables. The main independent variable of interest was *CEO private firm experience*. I manually collected the relevant information and constructed this variable in a three-step process. First, I downloaded the CVs of SOE CEOs from the CSMAR database and extracted the names of the firms where the CEO had previously worked, excluding firms that were subsidiaries of the focal SOE, as their strategies and decisions are controlled by the parent company. Second, I checked the ownership structures of the

extracted firms via the official Chinese enterprise inquiry platform QiChaCha (*https://www.qcc.com*). Ownership typologies mainly fall into three categories: state ownership, legal-person ownership, and individual ownership (Greve & Zhang, 2017). Based on this classification, a firm is referred to as a private firm if it is owned by individuals and/or private legal persons without state ownership. Conversely, a firm that is partially or wholly owned by the government is classified as an SOE. Finally, I coded *CEO private firm experience* as a dummy variable, which equals 1 if the CEO had prior work experience in at least one private firm, and 0 otherwise.

In addition, I measured *CEO international exposure* by manually checking the CEOs' overseas experience. In particular, a CEO is considered to have international exposure if he or she possesses professional or academic experience abroad, including in regions such as Hong Kong, Macau, or Taiwan. *CEO international exposure* equals 1 if the CEO had such international exposure, and 0 otherwise. The *level of stateness* variable captures state ownership, which is defined as the percentage of shareholdings owned by government entities.

Control variables. Following prior studies, I controlled for a vector of variables that are documented to affect firms' innovation activities at the CEO, firm, industry, and regional levels. At the firm level, I controlled for the following variables: *firm age* (the number of years since a firm's establishment), *firm size* (the natural logarithm of one plus the number of employees), and *ROA* (return on assets as a proxy for firm performance). Given the importance of organizational slack in influencing firm innovation (e.g., Damanpour, 1991), I also controlled for *financial slack*, defined as the ratio of current assets to current liabilities (Jia et al., 2019; Singh, 1986), and *potential slack*, defined as the ratio of debt to equity (Jia et al., 2019). To control for the input of a firm's innovation activity, *R&D investment*, I used the natural logarithm of one plus the amount of R&D input in a given

year. In addition, SOEs can be controlled by different levels of government, such as local and central governments, which may have different goals and affect innovation differently (e.g., Lin et al., 2021). Thus, I controlled for *central SOE dummy*, measured as 1 if the firm is owned by the central government, and 0 otherwise.

At the CEO level, I controlled for the following variables in the regression model. First, I controlled for CEOs' personal characteristics, including *CEO gender* (equal to 1 for male and 0 for female), *CEO age* (the number of years since birth), and *CEO education* (a category variable, measured as 0 for no education background, 1 for high school, 2 for junior college, 3 for bachelor's degree, 4 for master's degree, and 5 for a Doctor of Philosophy degree. I also controlled for *CEO tenure* (the number of years as CEO) because the longer a CEO works in the focal SOE, the less she/he may be affected by prior private firm experience in the decision-making process. *CEO duality dummy*, which indicates an overlap between the role of CEO and chairman of the board, and *CEO ownership* (the percentage of shares owned by the CEO) were both included in the model. To control for the potential effect of the CEO's prior work experience in SOEs, I included *CEO prior SOE experience* in the model. Following the three-step data collection process articulated for measuring *CEO private firm experience*, *CEO prior SOE experience* is measured as 1 if the CEO of the focal SOE previously worked in at least one firm that was partially or wholly owned by the government, and 0 otherwise.

Furthermore, I controlled for *industrial competition* and *institutional development*, both of which have been shown to influence firm innovation . I used the Herfindahl index to measure *industrial competition* (one minus industry concentration) (Zhou et al., 2017). The Herfindahl index is calculated at the three-digit industry level for each year, using the sales revenue to calculate the market share of each firm. The *institutional development* variable at the provincial level is measured as a composite "marketization" index,

compiled annually by the National Economic Research Institute in China (Fan et al., 2011). Finally, I included industry and year fixed effects to control for unobserved heterogeneity due to dynamic changes in the macroeconomic environment common to all firms over the sample period and industry-specific changes, respectively. Table 3.1 provides the measurements and data sources of all variables used in this study.

3.3.3 Research design

The dependent variable, *innovation performance*, is a highly right-skewed count variable that takes on non-negative integer values. Hence, I used a nonlinear regression approach to avoid heteroskedastic, non-normal residuals (Hausman et al., 1984). The poisson regression model assumes that data's mean and variance are consistent. When there exists over-dispersion of the data, negative binomial regression model would be more efficient. Therefore, considering that the dependent variable exhibits over-dispersion, with the variance largely exceeding the mean, I used the maximum likelihood estimation (MLE) of the negative binomial regression model with firm random effects to estimate such a count variable (Wang et al., 2022).

Table 3.1 Variable Measurements and Data Sources

Variables	Measurements	Data Sources
Dependent variable		
Innovation peformance *(Number of patents)*	The total number of patents applied by firms in a given year, including invention patents, design patents, and utility model patents.	CNIPA
Independent variables		
CEO private firm experience *(CEO private)*	A dummy variable which equals 1 if the CEO of the focal SOE has previous work experience in at least one firm owned by individuals and/or private legal persons without state shares and 0 otherwise.	CSMAR; Qichacha
CEO international exposure *(CEO interexposure)*	A dummy variable which equals 1 if the CEO of the focal SOE has overseas work and/or study experience and 0 otherwise.	CSMAR
Level of stateness *(Stateness)*	The percentage of shareholdings owned by the government.	CSMAR
Control variables		
Firm age *(Firm age)*	The number of years since the firm's establishment.	CSMAR
Firm size *(Firm size)*	The natural logarithm of one plus the number of employees.	CSMAR
ROA *(ROA)*	Return on assets, which equals net income divided by total assets.	CSMAR
Financial slack *(Financial slack)*	The ratio of current assets to current liabilities.	CSMAR
Potential slack *(Potential slack)*	The ratio of debt to equity.	CSMAR
R&D investment *(R&D)*	The natural logarithm of one plus the amount of R&D input of the focal firm in a given year.	CSMAR
Central SOE dummy *(Central SOE)*	A dummy variable which equals 1 if the firm is owned by the central government and 0 otherwise.	CSMAR
CEO gender *(CEO gender)*	A dummy variable which equals 1 for male and 0 for female.	CSMAR
CEO age *(CEO age)*	The number of years since the CEO's birth.	CSMAR
CEO education *(CEO education)*	A category variable which equals 0 if the CEO does not have an education background, 1 for high school, 2 for junior college, 3 for a bachelor's degree, 4 for a master's degree, and 5 for a Doctor of Philosophy degree.	CSMAR
CEO tenure *(CEO tenure)*	The number of years as CEO in the focal firm.	CSMAR
CEO duality dummy *(Duality)*	A dummy variable which equals 1 if the CEO also serves as the chairman in a given year and 0 otherwise.	CSMAR
CEO ownership *(CEO ownership)*	The percentage of shareholdings owned by the CEO.	CSMAR
CEO prior SOE experience *(CEO prior SOE)*	A dummy variable which equals 1 if the CEO of the focal SOE has previous work experience in at least one firm partially or totally owned by the government and 0 otherwise.	CSMAR; Qichacha
Industrial competition *(Indcompetition)*	One minus industry concentration calculated by the Herfindahl index at the three-digit industry level.	CSMAR
Institutional development *(Insdevelopment)*	A composite "marketization" index at the provincial level.	NERI

3.4 Empirical Results

3.4.1 Descriptive statistics and correlations

In Table 3.2, I report the descriptive statistics and correlations for the variables. The mean and standard deviation of *number of patents* are 51.74 and 115.90 respectively, indicating a substantial variation in innovation output among the sample firms. On average, only 15% of the firm-year observations have a CEO with private firm experience, while only 4% of the observations have a CEO with international exposure. The average percentage of state ownership (i.e., *level of stateness*) in the sample is 26%. A review of correlations suggests that multicollinearity among the explanatory variables is not a major concern in the sample, since the maximum variance inflation factor (VIF) is 1.74 (for *potential slack*) and the mean VIF is 1.23, which is significantly below the rule-of-thumb cutoff of 10 for regression models (Ryan, 1997).

3.4.2 Baseline results

Table 3.3 presents the estimation results for the effect of CEO private firm experience on SOE innovation performance. Models 1 and 2 include all the control variables without and with *CEO private firm experience*, respectively. The result for Model 2 supports Hypothesis 1, indicating that CEO private firm experience exerts a negative effect on SOEs' innovation performance. Consistent with this assertion, the coefficient of *CEO private firm experience* is negative and significant at the 1% significance level (β = -0.181; p = 0.002) in Model 2.

Model 3 shows the results of the moderating effect of CEO international exposure. Hypothesis 2 suggests that the negative effect of CEO private firm experience on SOE innovation performance is attenuated when the CEO has international exposure. Consistent with Hypothesis 2, the results show that the estimated coefficient of the interaction between *CEO private firm experience* and *CEO international exposure* is

significantly positive (β = 0.385; p = 0.050). Model 4 tests the moderating effect of the level of stateness. The coefficient of the interaction between *CEO private firm experience* and *level of stateness* is negative and significant (β = -0.854; p = 0.002), corroborating Hypothesis 3 that the negative effect of CEO private firm experience is stronger when the SOE has a higher level of state ownership. The final model (Model 5) includes all variables, including the two interaction terms above, and the results remain unchanged.

With respect to the effects of control variables, *firm age* has a significant and negative effect on innovation performance, while *firm size*, *ROA*, *R&D investment*, *central SOE dummy,* and *CEO education* have positive effects. Firms in more competitive industries and in the regions with higher levels of institutional development are found to produce more patents.

I further present two plotted figures to more clearly illustrate the moderating effects of CEO international exposure and level of stateness. Figure 3.2 shows the mitigating effect of CEO international exposure, while Figure 3.3 exhibits the aggravating effect of the level of stateness. In Figure 3.2 the number of patents of SOEs with CEOs having private firm experience is even higher than that of SOEs without CEO private firm experience, when the CEO has international exposure. However, Figure 3.3 shows that the negative influence of CEO private firm experience on innovation performance becomes stronger as the level of stateness increases.

Table 3.2 Descriptive Statistics and Correlations

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Number of patents	51.74	115.90																			
2. CEO private	0.15	0.35	-0.07																		
3. CEO interexposure	0.04	0.21	0.02	0.03																	
4. Stateness[b]	0.26	0.22	-0.04	-0.20	-0.08																
5. Firm age	14.64	5.51	-0.05	0.05	-0.02	-0.19															
6. Firm size[a]	7.86	1.40	0.46	-0.13	-0.02	0.08	-0.03														
7. ROA[b]	0.04	0.05	0.02	0.04	0.05	0.10	-0.10	-0.02													
8. Financial slack[b]	2.08	2.36	-0.07	0.06	0.10	-0.05	-0.15	-0.30	0.27												
9. Potential slack[b]	0.35	0.21	0.18	-0.10	-0.09	0.16	0.07	0.38	-0.38	-0.51											
10. R&D[a]	8.11	8.92	0.27	0.04	0.07	-0.21	0.03	0.13	0.05	0.18	-0.18										
11. Central SOE	0.27	0.44	0.19	-0.11	0.01	0.14	-0.08	0.18	-0.03	-0.02	0.06	0.05									
12. CEO gender	0.96	0.19	0.04	-0.05	0.01	0.04	-0.08	0.06	-0.02	0.01	0.01	-0.01	0.07								
13. CEO age	48.92	5.78	0.08	-0.06	0.07	0.03	0.10	0.14	0.02	-0.02	0.03	0.07	0.05	0.01							
14. CEO education	2.64	1.69	0.12	0.00	0.13	0.00	-0.18	0.09	0.07	0.10	-0.08	0.13	-0.02	0.00	0.00						
15. CEO tenure	3.88	2.89	0.07	-0.04	0.01	-0.18	0.14	0.09	-0.04	-0.14	0.05	-0.07	0.00	0.04	0.23	0.12					
16. Duality	0.16	0.37	0.03	0.09	0.05	-0.17	-0.04	-0.07	0.06	0.09	-0.12	0.11	-0.13	-0.01	0.13	0.10	0.07				
17. CEO ownership[b]	0.02	0.06	0.00	0.10	0.07	-0.21	-0.11	-0.12	0.12	0.22	-0.19	0.20	-0.12	-0.04	0.00	0.09	-0.06	0.41			
18. CEO prior SOE	0.54	0.50	0.06	-0.06	-0.03	0.13	0.03	0.07	-0.08	-0.07	0.13	-0.07	0.09	0.04	0.02	-0.14	-0.10	-0.09	-0.15		
19. Indcompetition[b]	0.88	0.14	-0.02	0.03	-0.01	-0.09	0.04	-0.09	-0.01	0.01	-0.01	0.11	-0.07	0.00	-0.03	-0.02	0.02	0.05	0.07	0.02	
20. Insdevelopment	7.14	1.73	0.16	0.10	0.07	-0.18	0.19	0.00	0.08	0.06	-0.08	0.26	-0.01	-0.07	0.10	0.04	0.01	0.09	0.15	-0.01	0.06

[a]Natural Logarithm.

[b]Percentage.

Table 3.3 CEO Private Firm Experience, CEO International Exposure, Level of Stateness, and Number of Patents (RE Model)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
CEO private		-0.181***	-0.204***	-0.045	-0.068
		(-3.104)	(-3.400)	(-0.629)	(-0.938)
CEO privateXCEO interexposure			0.385**		0.365*
			(1.961)		(1.855)
CEO privateXStateness				-0.854***	-0.839***
				(-3.133)	(-3.080)
CEO interexposure	0.015	0.017	-0.055	0.016	-0.052
	(0.194)	(0.209)	(-0.608)	(0.196)	(-0.582)
Stateness	-0.253***	-0.271***	-0.270***	-0.199**	-0.200**
	(-2.983)	(-3.180)	(-3.180)	(-2.277)	(-2.294)
Firm age	-0.015***	-0.016***	-0.016***	-0.015***	-0.015***
	(-3.204)	(-3.252)	(-3.334)	(-3.063)	(-3.147)
Firm size	0.354***	0.350***	0.350***	0.351***	0.350***
	(17.532)	(17.332)	(17.303)	(17.351)	(17.319)
ROA	2.370***	2.422***	2.441***	2.460***	2.480***
	(5.974)	(6.085)	(6.132)	(6.177)	(6.225)
Financial slack	0.018*	0.018*	0.019*	0.018*	0.019**
	(1.848)	(1.825)	(1.922)	(1.878)	(1.972)
Potential slack	0.303**	0.305**	0.314**	0.298**	0.307**
	(2.178)	(2.189)	(2.253)	(2.141)	(2.204)
R&D	0.017***	0.017***	0.017***	0.017***	0.017***
	(7.141)	(7.030)	(7.066)	(7.044)	(7.078)
Central SOE	0.386***	0.378***	0.380***	0.397***	0.398***
	(7.403)	(7.255)	(7.280)	(7.576)	(7.594)
CEO gender	-0.123	-0.130	-0.133	-0.141	-0.143
	(-1.197)	(-1.271)	(-1.297)	(-1.374)	(-1.395)
CEO age	-0.003	-0.004	-0.004	-0.004	-0.004
	(-0.991)	(-1.187)	(-1.141)	(-1.150)	(-1.089)
CEO education	0.054***	0.055***	0.056***	0.055***	0.056***
	(4.517)	(4.621)	(4.663)	(4.630)	(4.677)
CEO tenure	-0.006	-0.007	-0.007	-0.006	-0.006
	(-1.066)	(-1.188)	(-1.123)	(-1.069)	(-1.024)
Duality	0.075	0.085*	0.086*	0.083*	0.084*
	(1.539)	(1.746)	(1.766)	(1.710)	(1.732)
CEO ownership	0.200	0.239	0.283	0.204	0.247
	(0.614)	(0.731)	(0.863)	(0.624)	(0.753)
CEO prior SOE	-0.036	-0.031	-0.025	-0.030	-0.025
	(-0.961)	(-0.826)	(-0.681)	(-0.804)	(-0.669)
Indcompetition	0.437***	0.423***	0.423***	0.434***	0.434***
	(2.840)	(2.741)	(2.746)	(2.822)	(2.823)
Insdevelopment	0.143***	0.144***	0.144***	0.146***	0.145***
	(9.560)	(9.647)	(9.618)	(9.743)	(9.710)
Constant	-5.047***	-4.951***	-4.961***	-5.008***	-5.018***
	(-14.946)	(-14.628)	(-14.664)	(-14.775)	(-14.809)
Year fixed effect	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES
No. observation	4600	4600	4600	4600	4600
Number of groups	1571	1571	1571	1571	1571
Log likelihood	-16395.05	-16390.09	-16388.29	-16384.85	-16383.23
Chi-square	3415.82	3436.96	3448.46	3435.02	3445.50
P-value for model test	0.000	0.000	0.000	0.000	0.000

Note: z-statistics of variables are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Figure 3.2 Plot of the Interaction between CEO Private Firm Experience and CEO International Exposure (With 95% Confidence Intervals)

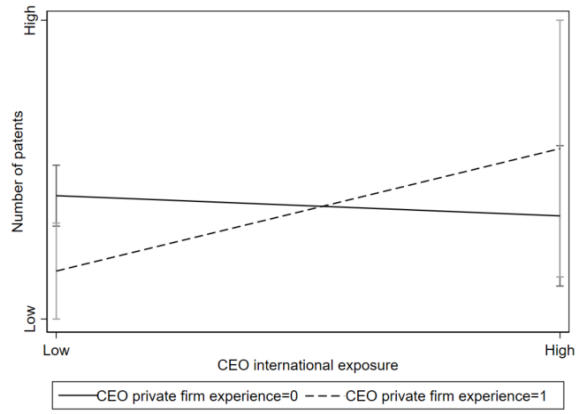
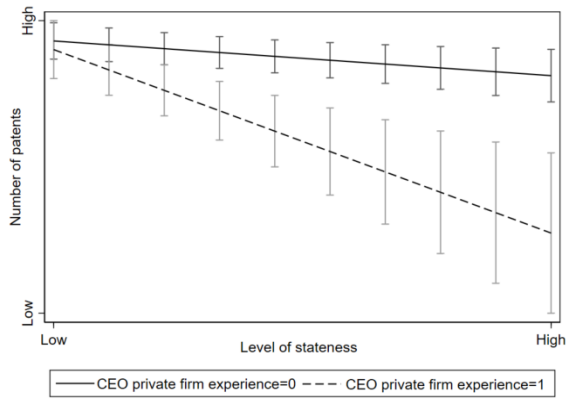


Figure 3.3 Plot of the Interaction between CEO Private Firm Experience and Level of Stateness (With 95% Confidence Intervals)



3.4.3 Robustness tests

While the preceding analyses provide empirical evidence supporting the three hypotheses, they are subject to potential biases that could confound their interpretation. For example, a prominent concern is that the appointment of a CEO with private firm experience in SOEs may not be random, thus introducing sample selection bias. Furthermore, it is possible that the results are driven by omitted variables that simultaneously affect both the appointment of the CEO with private firm experience and corporate innovation. Therefore, I conducted several additional tests to address these concerns, applying the Heckman two-stage selection model, the propensity score matching (PSM) procedure, and alternative model specifications and measures of the dependent variable.

Heckman two-stage sample selection model. A firm's decision to appoint a CEO with private firm experience may not be random, introducing a self-selection bias. To address this concern, I adopted the Heckman two-step selection model as a robustness test. In the first step, I estimated a probit model with CEO private firm experience as the dependent variable. It is important to note that the Heckman estimator requires the inclusion of at least one exogenous variable that is correlated with CEO private firm experience but orthogonal to corporate innovation. Accordingly, I used an instrumental variable, *birthyear1970*, to satisfy the exclusion restriction in the first stage model. *Birthyear1970* is an indicator variable that equals 1 if a CEO was born after 1970, and 0 otherwise.

The Chinese historical context provides the rationale for the use of this instrumental variable. The Seventh National People's Congress in 1988 witnessed the formal recognition of the legal status of the Chinese private sector through an amendment to the Constitution. Given that the legal age of adulthood in China is 18, CEOs born after 1970 would have entered the workforce at a time when private firms had gained legal

legitimacy, making these CEOs more predisposed to gain experience in private firms. On the other hand, whether a CEO was born after 1970 or not is unlikely to affect or closely correlate with corporate innovation.

The results of the first-step regression are reported in Model 1 of Table 3.4. Consistent with the conjecture that CEOs born after 1970 are more likely to have private firm experience, the coefficient on *birthyear1970* is positive and significant (p = 0.002). I derived the inverse Mills ratio (IMR) from the first step and then included it in the second-step model to account for potential sample selection bias. The results of the second-stage regressions, as shown in Table 3.4, continue to support the hypotheses. The coefficients of *CEO private firm experience* (β = -0.183; p = 0.002) in Model 3, the interaction between *CEO private firm experience* and *CEO international exposure* (β = 0.388; p = 0.048) in Model 4, and the interaction between *CEO private firm experience* and *Level of stateness* (β = -0.861; p = 0.002) in Model 5 are all consistent with the previous findings, both in terms of magnitude and the predicted signs.

PSM procedure. To further address the possible sample selection bias, I employed PSM techniques. In particular, I conducted the PSM procedure by matching firms whose CEOs have private firm experience (i.e., the treatment group) with SOEs whose CEOs lack such experience (i.e., the control group). The PSM matching was facilitated by a logit model that included the control variables described in Model 1 of Table 3.3, and I used radius matching with a caliper of 0.01. To ensure the effectiveness of the matching process, I assessed the covariate balance and conducted tests to detect any significant differences in means and medians between the matched treatment and control group. The results are reported in Panel A of Table 3.5.

As shown in Panel A of Table 3.5, the differences in the mean values of the variables between the treatment and control groups after the PSM procedure are statistically

insignificant. Moreover, the pseudo-R^2 of the matched sample is remarkably small (0.001), with a *p*-value of 1.000. Notably, after the PSM matching, the mean bias is reduced from 20.6 to 1.3, while the median bias shrinks from 16.9 to 1.0. Overall, these results indicate that the propensity-score-matched control group is similar to the treatment group in terms of mean and median values.

I re-ran all the models in Table 3.3 using the matched sample. The results presented in Panel B of Table 3.5 remain consistent. The coefficients of *CEO private firm experience* in Model 2 and the interaction between *CEO private firm experience* and *Level of stateness* in Model 4 continue to be significantly negative at the 1% level. Conversely, the coefficient of the interaction term between *CEO private firm experience* and *CEO international exposure* in Model 3 remains positive and significant ($p = 0.051$).

Firm fixed effects model. Next, I re-estimated the regressions from the main analysis using firm fixed effects, aiming to mitigate the potential bias arising from unobserved, time-invariant, firm-specific characteristics. The results, shown in Table 3.6, lend support to the hypotheses. After accounting for unobserved firm-specific heterogeneity, the coefficient of *CEO private firm experience* remains negative and significant in Model 2 ($p = 0.017$), supporting Hypothesis 1. Similarly, in Model 3 (Model 4), the coefficients of the interaction term between *CEO private firm experience* and *CEO international exposure* (*Level of stateness*) remain positive (negative) and significant, consistent with Hypothesis 2 (Hypothesis 3).

Alternative measure for innovation performance. In the final robustness test, I used *number of invention patents* as an alternative measure of dependent variable, which is defined as the number of invention patents filed by firms in a given year. Among the three different types of patents (i.e., invention, utility, and design patents), invention patents are of the highest novelty and technological inventiveness (Li et al., 2020). For an invention

to be granted, the application must meet strict criteria of novelty, inventiveness, and practical applicability. Thus, the number of invention patents serves as a strong indicator of a firm's high-level innovation capability. The results in Table 3.7 provide robust support for Hypothesis 1 (Model 2) and Hypothesis 3 (Model 4). However, I did not find any empirical support for Hypothesis 2 in this context.

Table 3.4 Heckman Two-Stage Analysis

Variable	First-stage	Second-stage regressions				
	CEO private	Number of patents				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Birthyear1970	0.283***	/	/	/	/	/
	(3.056)	/	/	/	/	/
CEO private	/		-0.183***	-0.205***	-0.045	-0.069
	/		(-3.130)	(-3.428)	(-0.636)	(-0.948)
CEO privateXCEO	/			0.388**		0.368*
	/			(1.975)		(1.871)
CEO privateXStateness	/				-0.861***	-0.846***
	/				(-3.155)	(-3.102)
CEO interexposure	0.075	0.006	0.006	-0.066	0.004	-0.065
	(0.655)	(0.068)	(0.068)	(-0.719)	(0.045)	(-0.705)
Stateness	-1.394***	-0.081	-0.074	-0.072	0.014	0.016
	(-9.189)	(-0.206)	(-0.190)	(-0.185)	(0.037)	(0.042)
Firm age	0.001	-0.016***	-0.016***	-0.017***	-0.015***	-0.016***
	(0.131)	(-3.292)	(-3.352)	(-3.433)	(-3.171)	(-3.257)
Firm size	-0.091***	0.364***	0.362***	0.362***	0.363***	0.363***
	(-3.970)	(11.343)	(11.280)	(11.262)	(11.324)	(11.307)
ROA	1.179**	2.236***	2.269***	2.287***	2.293***	2.311***
	(2.126)	(4.488)	(4.555)	(4.590)	(4.604)	(4.638)
Financial slack	-0.018	0.020*	0.020*	0.021**	0.021*	0.022**
	(-1.469)	(1.877)	(1.883)	(1.974)	(1.951)	(2.040)
Potential slack	-0.370**	0.350**	0.358**	0.368**	0.355**	0.365**
	(-2.064)	(2.041)	(2.085)	(2.141)	(2.070)	(2.126)
R&D	-0.006	0.018***	0.017***	0.017***	0.017***	0.018***
	(-1.536)	(6.212)	(6.156)	(6.183)	(6.187)	(6.214)
Central SOE	-0.188***	0.411***	0.407***	0.409***	0.428***	0.430***
	(-3.095)	(5.662)	(5.611)	(5.636)	(5.887)	(5.908)
CEO gender	-0.007	-0.122	-0.129	-0.132	-0.140	-0.142
	(-0.062)	(-1.184)	(-1.258)	(-1.284)	(-1.363)	(-1.385)
CEO age	-0.001	-0.002	-0.003	-0.003	-0.003	-0.003
	(-0.233)	(-0.610)	(-0.746)	(-0.703)	(-0.690)	(-0.633)
CEO education	0.015	0.053***	0.054***	0.055***	0.054***	0.054***
	(0.947)	(4.189)	(4.273)	(4.315)	(4.268)	(4.313)
CEO tenure	-0.041***	-0.001	-0.001	-0.001	0.000	0.000
	(-4.293)	(-0.089)	(-0.092)	(-0.057)	(0.003)	(0.032)
Duality	0.151**	0.057	0.064	0.065	0.061	0.061
	(2.215)	(0.895)	(1.018)	(1.030)	(0.962)	(0.972)
CEO ownership	0.044	0.198	0.237	0.281	0.201	0.245
	(0.109)	(0.608)	(0.726)	(0.858)	(0.617)	(0.746)
CEO prior SOE	-0.063	-0.029	-0.023	-0.017	-0.021	-0.016
	(-1.265)	(-0.710)	(-0.561)	(-0.426)	(-0.524)	(-0.397)
Indcompetition	-0.312	0.476***	0.466***	0.467***	0.482***	0.482***
	(-1.469)	(2.696)	(2.641)	(2.646)	(2.733)	(2.737)
Insdevelopment	0.037**	0.138***	0.139***	0.138***	0.140***	0.139***
	(2.320)	(7.620)	(7.660)	(7.631)	(7.712)	(7.678)
Inverse Mills ratio	/	-0.148	-0.168	-0.170	-0.183	-0.186
	/	(-0.454)	(-0.518)	(-0.522)	(-0.562)	(-0.570)
Constant	-0.003	-4.966***	-4.860***	-4.869***	-4.912***	-4.920***
	(-0.008)	(-13.622)	(-13.300)	(-13.331)	(-13.426)	(-13.454)
Year fixed effect	YES	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES	YES
No. observation	4657	4584	4584	4584	4584	4584
Number of groups	/	1571	1571	1571	1571	1571
Log likelihood	-1710.53	-16367.46	-16362.41	-16360.58	-16357.1	-16355.45
Chi-square	422.15	3391.92	3413.22	3424.79	3411.12	3421.68
P-value for model test	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	0.12	/	/	/	/	/

Note: z-statistics of variables are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 3.5 PSM Procedure

Panel A The results of covariate balance checks

Variable	Means		P values
	Treated group	Matched controlled group	
CEO interexposure	0.058	0.060	0.881
Stateness	0.154	0.158	0.678
Firm age	15.271	15.221	0.872
Firm size	7.436	7.419	0.808
ROA	0.043	0.043	0.871
Financial slack	2.423	2.490	0.670
Potential slack	0.293	0.291	0.859
R&D	9.010	9.054	0.927
Central SOE	0.152	0.150	0.892
CEO gender	0.945	0.944	0.942
CEO age	48.060	48.097	0.913
CEO education	2.655	2.674	0.827
CEO tenure	3.593	3.629	0.812
Duality	0.248	0.253	0.848
CEO ownership	0.031	0.033	0.730
CEO prior SOE	0.459	0.452	0.809
Indcompetition	0.889	0.890	0.872
Insdevelopment	7.542	7.605	0.507

Panel B The regression results using PSM procedure

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
CEO private		-0.184***	-0.206***	-0.053	-0.076
		(-3.147)	(-3.440)	(-0.741)	(-1.047)
CEO privateXCEO interexposure			0.383*		0.363*
			(1.949)		(1.848)
CEO privateXStateness				-0.821***	-0.806***
				(-3.008)	(-2.954)
CEO interexposure	0.016	0.017	-0.054	0.016	-0.052
	(0.196)	(0.213)	(-0.601)	(0.199)	(-0.577)
Stateness	-0.289***	-0.307***	-0.307***	-0.236***	-0.237***
	(-3.330)	(-3.534)	(-3.534)	(-2.633)	(-2.650)
Firm age	-0.015***	-0.015***	-0.016***	-0.014***	-0.015***
	(-3.116)	(-3.166)	(-3.247)	(-2.985)	(-3.069)
Firm size	0.352***	0.348***	0.348***	0.348***	0.348***
	(17.345)	(17.146)	(17.119)	(17.160)	(17.129)
ROA	2.417***	2.470***	2.490***	2.507***	2.527***
	(6.050)	(6.163)	(6.211)	(6.251)	(6.299)
Financial slack	0.017*	0.017*	0.018*	0.017*	0.018*
	(1.788)	(1.767)	(1.863)	(1.815)	(1.908)
Potential slack	0.311**	0.313**	0.322**	0.306**	0.315**
	(2.221)	(2.234)	(2.299)	(2.189)	(2.252)
R&D	0.017***	0.017***	0.017***	0.017***	0.017***
	(7.103)	(6.984)	(7.021)	(7.015)	(7.049)
Central SOE	0.384***	0.376***	0.378***	0.394***	0.396***
	(7.362)	(7.213)	(7.239)	(7.517)	(7.536)
CEO gender	-0.126	-0.133	-0.136	-0.143	-0.145
	(-1.224)	(-1.298)	(-1.324)	(-1.397)	(-1.418)
CEO age	-0.003	-0.004	-0.004	-0.004	-0.004
	(-0.941)	(-1.140)	(-1.092)	(-1.104)	(-1.042)
CEO education	0.054***	0.055***	0.056***	0.056***	0.056***
	(4.514)	(4.620)	(4.663)	(4.626)	(4.673)
CEO tenure	-0.006	-0.007	-0.007	-0.006	-0.006
	(-1.053)	(-1.179)	(-1.116)	(-1.061)	(-1.016)
Duality	0.073	0.083*	0.084*	0.081*	0.082*

	(1.488)	(1.700)	(1.719)	(1.667)	(1.688)
CEO ownership	0.186	0.225	0.269	0.192	0.235
	(0.573)	(0.690)	(0.821)	(0.589)	(0.717)
CEO prior SOE	-0.037	-0.032	-0.026	-0.031	-0.026
	(-0.984)	(-0.847)	(-0.703)	(-0.829)	(-0.694)
Indcompetition	0.449***	0.435***	0.435***	0.445***	0.444***
	(2.887)	(2.792)	(2.794)	(2.865)	(2.864)
Insdevelopment	0.142***	0.143***	0.143***	0.145***	0.144***
	(9.494)	(9.582)	(9.553)	(9.672)	(9.640)
Constant	-5.034***	-4.938***	-4.947***	-4.992***	-5.001***
	(-14.899)	(-14.581)	(-14.618)	(-14.720)	(-14.754)
Year fixed effect	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES
No. observation	4588	4588	4588	4588	4588
Number of groups	1569	1569	1569	1569	1569
Log likelihood	-16323.03	-16317.93	-16316.14	-16313.11	-16311.51
Chi-square	3384.13	3405.75	3416.94	3404.03	3414.26
P-value for model test	0.000	0.000	0.000	0.000	0.000

Note: z-statistics of variables are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 3.6 CEO Private Firm Experience, CEO International Exposure, Level of Stateness, and Number of Patents (FE Model)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
CEO private		-0.182**	-0.209***	-0.036	-0.063
		(-2.390)	(-2.669)	(-0.383)	(-0.666)
CEO privateXCEO interexposure			0.415*		0.404*
			(1.812)		(1.776)
CEO privateXStateness				-0.803**	-0.796**
				(-2.534)	(-2.513)
CEO interexposure	0.128	0.137	0.053	0.136	0.053
	(1.345)	(1.436)	(0.490)	(1.424)	(0.483)
Stateness	-0.308***	-0.315***	-0.312***	-0.252**	-0.250**
	(-3.066)	(-3.133)	(-3.110)	(-2.444)	(-2.429)
Firm age	-0.014*	-0.014*	-0.015**	-0.013*	-0.013*
	(-1.868)	(-1.910)	(-1.998)	(-1.748)	(-1.841)
Firm size	0.269***	0.266***	0.266***	0.267***	0.266***
	(10.243)	(10.155)	(10.133)	(10.173)	(10.146)
ROA	2.115***	2.136***	2.166***	2.163***	2.197***
	(4.682)	(4.714)	(4.776)	(4.773)	(4.842)
Financial slack	0.033***	0.033***	0.034***	0.034***	0.035***
	(2.579)	(2.600)	(2.691)	(2.652)	(2.745)
Potential slack	0.044	0.040	0.054	0.031	0.045
	(0.269)	(0.243)	(0.327)	(0.186)	(0.273)
R&D	0.004*	0.004	0.004	0.004	0.004*
	(1.695)	(1.560)	(1.634)	(1.579)	(1.654)
Central SOE	0.235***	0.228***	0.230***	0.251***	0.253***
	(3.385)	(3.273)	(3.307)	(3.577)	(3.606)
CEO gender	-0.182	-0.189	-0.190	-0.201*	-0.201*
	(-1.499)	(-1.568)	(-1.575)	(-1.665)	(-1.670)
CEO age	-0.000	-0.001	-0.001	-0.001	-0.001
	(-0.108)	(-0.249)	(-0.193)	(-0.214)	(-0.142)
CEO education	0.049***	0.050***	0.051***	0.051***	0.052***
	(3.420)	(3.526)	(3.591)	(3.563)	(3.634)
CEO tenure	-0.009	-0.009	-0.009	-0.009	-0.008
	(-1.355)	(-1.372)	(-1.286)	(-1.283)	(-1.214)
Duality	0.041	0.050	0.053	0.045	0.048
	(0.707)	(0.847)	(0.903)	(0.771)	(0.830)
CEO ownership	0.101	0.144	0.243	0.105	0.204
	(0.208)	(0.296)	(0.496)	(0.215)	(0.417)
CEO prior SOE	0.020	0.030	0.035	0.026	0.031
	(0.447)	(0.653)	(0.764)	(0.584)	(0.690)
Indcompetition	0.242	0.225	0.233	0.235	0.242
	(1.224)	(1.140)	(1.181)	(1.195)	(1.233)
Insdevelopment	0.049**	0.050**	0.050**	0.053**	0.053**
	(2.209)	(2.273)	(2.275)	(2.380)	(2.380)
Constant	-2.970***	-2.894***	-2.934***	-2.964***	-3.005***
	(-6.607)	(-6.433)	(-6.519)	(-6.579)	(-6.664)
Firm fixed effect	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES
No. observation	3395	3395	3395	3395	3395
Number of groups	818	818	818	818	818
Log likelihood	-8928.57	-8925.607	-8924.08	-8922.224	-8920.754
Chi-square	1473.65	1485.17	1491.36	1486.50	1492.19
P-value for model test	0.000	0.000	0.000	0.000	0.000

Note: z-statistics of variables are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 3.7 CEO Private Firm Experience, CEO International Exposure, Level of Stateness, and Number of Invention Patents

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
CEO private		-0.199***	-0.209***	-0.072	-0.082
		(-3.024)	(-3.108)	(-0.919)	(-1.041)
CEO privateXCEO interexposure			0.165		0.184
			(0.761)		(0.855)
CEO privateXStateness				-0.850***	-0.858***
				(-2.825)	(-2.848)
CEO interexposure	0.040	0.049	0.018	0.053	0.018
	(0.461)	(0.570)	(0.185)	(0.619)	(0.189)
Stateness	-0.207**	-0.228**	-0.229**	-0.165*	-0.166*
	(-2.275)	(-2.495)	(-2.508)	(-1.768)	(-1.778)
Firm age	-0.016***	-0.016***	-0.017***	-0.016***	-0.016***
	(-2.950)	(-3.026)	(-3.059)	(-2.882)	(-2.920)
Firm size	0.360***	0.356***	0.355***	0.355***	0.355***
	(16.035)	(15.820)	(15.806)	(15.815)	(15.797)
ROA	2.084***	2.125***	2.134***	2.140***	2.151***
	(4.885)	(4.967)	(4.986)	(5.002)	(5.026)
Financial slack	0.027**	0.027**	0.027**	0.027**	0.028**
	(2.456)	(2.433)	(2.473)	(2.514)	(2.561)
Potential slack	0.216	0.216	0.222	0.217	0.224
	(1.399)	(1.395)	(1.432)	(1.408)	(1.448)
R&D	0.012***	0.012***	0.012***	0.012***	0.012***
	(4.981)	(4.944)	(4.965)	(4.981)	(5.005)
Central SOE	0.437***	0.425***	0.426***	0.439***	0.440***
	(7.444)	(7.233)	(7.249)	(7.464)	(7.483)
CEO gender	-0.114	-0.121	-0.123	-0.131	-0.133
	(-1.013)	(-1.086)	(-1.098)	(-1.178)	(-1.191)
CEO age	-0.005	-0.006	-0.006	-0.006	-0.006
	(-1.442)	(-1.632)	(-1.629)	(-1.548)	(-1.534)
CEO education	0.055***	0.055***	0.055***	0.056***	0.056***
	(4.153)	(4.186)	(4.205)	(4.234)	(4.260)
CEO tenure	-0.005	-0.006	-0.006	-0.006	-0.006
	(-0.812)	(-0.971)	(-0.938)	(-0.974)	(-0.945)
Duality	0.052	0.064	0.065	0.064	0.065
	(0.984)	(1.205)	(1.225)	(1.203)	(1.225)
CEO ownership	0.062	0.082	0.099	0.038	0.057
	(0.176)	(0.232)	(0.279)	(0.107)	(0.160)
CEO prior SOE	-0.013	-0.009	-0.006	-0.010	-0.008
	(-0.322)	(-0.209)	(-0.153)	(-0.250)	(-0.189)
Indcompetition	0.266	0.254	0.255	0.271	0.272
	(1.492)	(1.424)	(1.430)	(1.527)	(1.534)
Insdevelopment	0.154***	0.156***	0.156***	0.157***	0.156***
	(8.972)	(9.104)	(9.099)	(9.170)	(9.163)
Constant	-4.910***	-4.805***	-4.808***	-4.867***	-4.872***
	(-12.636)	(-12.327)	(-12.340)	(-12.474)	(-12.491)
Year fixed effect	YES	YES	YES	YES	YES
Industry fixed effect	YES	YES	YES	YES	YES
No. observation	4600	4600	4600	4600	4600
Number of groups	1571	1571	1571	1571	1571
Log likelihood	-12869.8	-12865.1	-12864.82	-12860.83	-12860.47
Chi-square	2708.51	2724.23	2726.83	2720.76	2723.44
P-value for model test	0.000	0.000	0.000	0.000	0.000

Note: z-statistics of variables are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

3.5 Discussion and Conclusions

Using an institutional logics perspective, I investigated whether and how CEOs experiencing conflicting logics stemming from prior and current experience in different firm contexts affects firm outcomes. I sought an answer to this question by investigating the conflict between market logic acquired by a CEO through previous work experience in private firms and the state logic dominant in SOEs, and whether such logic conflicts experienced by CEOs affect SOEs' innovation performance. Based on a longitudinal panel dataset of listed Chinese SOEs from 2008 to 2016, I found that CEOs' private firm experience significantly reduced SOEs' innovation performance and this negative effect decreased when the CEO had international exposure, while it increased in SOEs with high levels of stateness. These findings provide novel insights into the role of the CEO in SOEs and contribute to existing literature in three ways.

First, I contribute to the institutional logics perspective by advancing how individual exposure to conflicting institutional logics shapes organizational outcomes. Prior studies have shed light on how individuals experience, assess, and enact institutional expectations, which is critical to understanding organizational responses to conflicting institutional demands (Mangen & Brivot, 2014; Pache et al., 2024; Pache & Santos, 2010; Smith & Besharov, 2017). Building on this, a few scholars have paid attention to how the individual agency underpinning a particular logic affects organizational outcomes (Almandoz, 2012; Boone et al., 2022; Pache & Santos, 2010), such as establishing a new bank (Almandoz, 2012), risk exposure of a bank (Almandoz, 2014), and a firm's M&A decisions (Greve & Zhang, 2017). These existing studies mostly assume that an individual represents only one of the two conflicting institutional logics (Almandoz, 2014; Boone et al., 2022; Pache & Santos, 2010). However, they overlook potential conflicting logics experienced by an individual decision-maker (e.g., CEOs) due to socialization during

different prior and current professional contexts. We still know little about whether and how such logic conflicts shape CEOs' cognition, guide their behaviors and decisions in their current firms, and ultimately affect firm outcomes.

In this study, I found strong empirical evidence that the conflicts between market logic and state logic experienced by a CEO with prior private firm experience will significantly hinder an SOE's innovation performance and such negative effects will be weakened if the CEO has international exposure and strengthened in SOEs with high levels of stateness. My findings reveal how the individual embeddedness in conflicting logics shapes CEOs' actions and decisions (Thornton & Ocasio, 2008) and thus affects firm-level outcomes (Besharov & Smith, 2014; Suddaby, 2010), especially in innovation. Notably, diverging from prior literature that assumes one individual represents only one institutional logic, I highlight that individuals may be embedded in and enact two conflicting logics through their past and current working experience. Such complex embeddedness carries significant implications for firm innovation. In doing so, I shed light on the intricacies of individual exposure to conflicting institutional logics, an important topic warranting more work in the future, as indicated by Greenwood et al. (2017).

Second, my study connects the literature on institutional logics with upper echelons theory (Hambrick & Mason, 1984) to reveal the influence of top managers on firm innovation (Bantel & Jackson, 1989; Damanpour & Schneider, 2006; Elenkov & Manev, 2005). Existing studies explore the differences in top managers' characteristics, incentives, and cognitive abilities and their effects on innovation (e.g., Galasso & Simcoe, 2011; Lin et al., 2011; Yadav et al., 2007; Zhang et al., 2017). For example, Lin et al. (2011) found that incentives that align CEOs' interests with firms' long-term goals can promote firm innovation and CEO education level, professional background, and political connections

can also promote R&D intensity. Zhang et al. (2017) interestingly found that CEOs who are both humble and narcissistic are more likely to cultivate an innovative culture and deliver innovative performance. Nevertheless, these studies cannot explain variances arising from logic conflicts. From an institutional logics perspective, my study reveals that logic conflicts faced by CEOs cause cognitive dissonance and impede firm innovation. I advance our understanding of the role of top managers (i.e., CEOs) in firm innovation by linking CEOs' experience and cognition with innovation performance from the perspective of institutional logics. In doing so, I highlight the value of integrating institutional logics into upper echelon research to better understand the mechanisms underlying how top managers' characteristics improve or inhibit firm innovation.

Finally, I contribute to SOE literature by introducing the aspect of CEO heterogeneity within SOEs, especially in the innovation context. Previous research has compared variances in innovation between private firms and SOEs (Clò et al., 2020; Lazzarini et al., 2021; Zhou et al., 2017) and explored innovation variances in different types of SOEs, such as minority vs. majority SOEs (Zhou et al., 2017) and local vs. central SOEs (Lin et al., 2021). However, those studies implicitly assumed that CEOs of SOEs are homogenous in interpreting the environment and making decisions on innovation (e.g., Zhou et al., 2017) and neglected to consider that CEOs' heterogeneities are likely to influence SOEs' innovation performance. The results show that if the CEO has private firm experience, that impedes an SOE's innovation performance, especially in an SOE with a high level of stateness; however, such a negative effect can be mitigated if the CEO also has international exposure. Thus, I advance SOE innovation literature by unveiling an important micro-source of SOEs' innovation performance variance—CEOs' prior private firm experience—thus showing how heterogeneity at the individual level affects firm-level outcomes in SOEs.

Practical implications. Except for theoretical contributions, my study also offers important implications for managers and policymakers in driving firm innovation. I find that a CEO's exposure to logic conflicts may cause cognitive dissonance and thus impede the firm's innovation performance. This study does not suggest that we cannot hire a CEO with private experience. Instead, I recognize the benefits of diverse experience but suggest that when appointing a CEO with prior work experience in private firms, SOE managers and the government be aware of the possible cognitive challenges facing these CEOs because they will impede SOE innovation. In addition, managers and policymakers should also jointly evaluate other factors to understand the degree of conflicts CEOs may experience, especially CEOs' foreign experience and the level of SOE state ownership. Furthermore, to fully leverage the diverse experiences of CEOs, SOEs and the government should develop policies and mechanisms that can support CEOs who are experiencing conflicting logics and assist them in reducing the cognitive dissonance associated with logic conflicts.

Limitations and future research. My study has several limitations which pose opportunities for future research. First, I posit that exposing SOEs' CEOs with private firm experience to conflicting logics is likely to cause cognitive dissonance, reducing CEOs' cognitive ability and attitude to conduct innovation and, thus, impeding SOEs' innovation performance. However, due to limited data, I am not able to explicitly test this mechanism. Future research should delineate this argument and assess possible mediating effects by using firsthand survey data.

Second, due to limited data in this study, I focus only on whether the CEO has private firm experience, but the variance of private firm experiences should be considered. Differences in CEOs' work experience in private firms, such as years worked and in what position (e.g., as CEO or normal employee), can affect the extent to which a CEO's

cognition is influenced by market logic. Future studies could validate my research by collecting more detailed data on CEOs' work experience in private firms. Furthermore, although I conduct several robustness tests to prove the confidence in the results and mitigate the potential bias arising from unobserved variables, some firm factors (e.g., political connections or strategic priorities of SOEs) which might influence the observed relationships, should be addressed more thoroughly.

Last, my study is situated in a particular context—SOEs in China with coexisting market and state logics. Due to the influence of external economic factors or organizational culture that could affect the generalizability of the resutls, future research should examine the effects of logic conflicts experienced by the CEO on innovation in other contexts, such as in emerged economies. Moreover, future research could also investigate the effects of different logic conflicts experienced by the CEO in other hybrid firms with different organizational culture, such as social firms or family firms.

4. Study Three: Managers-Employees Pay Disparity and State-Owned Enterprises' Innovation: Evidence from a Quasi-Natural Experiment

4.1 Introduction

State-owned enterprises (SOEs), which are owned and controlled by the government (OECD, 2017), contribute significantly to national economic growth (Bruton et al., 2015; Cuervo-Cazurra et al., 2022; Musacchio & Lazzarini, 2014) and innovation capability across countries (Wang et al., 2022; Zhou et al., 2017). Accordingly, research on SOE innovation has drawn increasing attention from scholars (Genin et al., 2021; Jia et al., 2019; Zhou et al., 2017). Governments play an important role in SOE innovation, and existing studies have therefore mainly focused on how government affects firm innovation by directly owning shares, which impacts SOEs' corporate governance (Lazzarini et al., 2021; Yi et al., 2017; Zhou et al., 2017). Corporate governance comprises multiple aspects (e.g., ownership structure, board of directors, and compensation practices) and is one of the main determinants of technological innovation (Asensio-López et al., 2019; Belloc, 2012; Gonzales-Bustos & Hernández-Lara, 2016). However, few studies have examined how government impacts SOE innovation by directly changing a firm's compensation practices. Scholars have shown that compensation practices or structure can shape incentives for executives and employees to conduct innovation (Liu & Lv, 2022; Quinn & Rivoli, 1991; Zhou et al., 2021). Nevertheless, little is known about how a government-driven change in SOEs' compensation structure, especially the pay disparity between managers and ordinary employees (hereafter 'employees'), affects SOE innovation.

To address this important issue, this study theorizes and empirically examines through a quasi-natural experiment the causal effect of SOEs' pay disparity on their innovation performance. The existing literature has well-documented the positive and negative performance implications of pay disparity between managers and employees (Banker et al., 2016; Faleye et al., 2013), mainly drawing on two competing theories, comparison theories and tournament theory. According to comparison theories, including equity theory (Adams, 1965) and relative deprivation theory (Martin, 1981), individuals tend to experience stronger feelings of inequity or deprivation if they find their rewards are fewer than they deserve compared to rewards received by their reference group (Adams, 1965; Cowherd & Levine, 1992; Martin, 1981). In response, individuals would attempt to resolve their perceived feelings of inequity by reducing their actual inputs, ending the inequitable relationship by leaving their firms or even retaliating regardless of their own welfare (Cowherd & Levine, 1992; Xu et al., 2017). In line with this, studies have found that high managers-employees pay disparity leads to high managerial turnover and lower productivity (Bloom & Michel, 2002; Firth et al., 2015). On the contrary, the tournament theory proposes that employees are motivated to invest greater effort into obtaining the pay increase associated with promotion in a firm's compensation hierarchy (Lazear & Rosen, 1981). Following this, empirical evidence confirms a positive relationship between managers-employees pay disparity and firm performance (e.g., Banker et al., 2016; Lallemand et al., 2004). Although these studies shed light on the impact of pay disparity, they predominantly focus on financial performance. There remains a dearth of understanding regarding how pay disparity between managers and employees affects innovation, especially for SOEs.

In this study, I use China's recent reform to conduct a quasi-natural experiment, which provides a unique opportunity to study the causal relationship between managers-

employees pay disparity and innovation. In January 2015, the Chinese government implemented a reform to regulate executive compensation, particularly targeting SOEs (hereafter 'the Reform'). This Reform implemented specific requirements about 'downward' executive compensation adjustments and establishing a reasonable income distribution between managers and employees. The Reform is widely recognized as unexpected and unprecedented, generating exogenous variations in pay disparities within SOEs (Lin, 2017).

Based on the comparison theories (Adams, 1965; Cowherd & Levine, 1992; Martin, 1981), I suggest that reduced pay disparity between managers and employees in SOEs can enhance employees' feelings of equity, reducing their costly behavior and increasing their satisfaction and engagement, which in turn promotes firm innovation performance. Using a sample of listed Chinese firms from 2007 to 2022, I employ a difference-in-difference (DID) model to estimate the causal effects and find a significantly positive relationship between reduced pay disparity in SOEs and firm innovation performance. Furthermore, using proxies for employees' feelings of equity, my mechanism analyses reveal that reduced pay disparity in SOEs enhances employees' feelings of equity, incentivizing them to innovate. Further, the additional heterogeneity analyses indicate that the enhancing effect of the reduced pay disparity on innovation performance is more salient in SOEs with better corporate governance, in industries with higher degrees of monopolization, and in regions with less-developed institutional development.

Overall, this study makes several contributions to existing literature on SOEs, pay disparity and innovation. First, I contribute to the SOE innovation literature, which underestimates the innovation implications of governments' endeavors to reduce pay inequity between managers and employees within SOEs. Through the application of a quasi-natural experiment, I shed light on the causal effect of pay disparity in SOEs on

firm innovation performance as well as its underlying mechanism. The results carry significant policy implications, indicating that governments' impact on improving SOE innovation goes beyond being a mere resource provider or operation supervisor; the state can boost SOE innovation by addressing pay disparity within SOEs and cultivating an equitable environment, which are both important to inspire innovative ideas and behavior and mitigate inefficiencies associated with SOEs.

Second, I also contribute to the literature on pay disparity. Existing literature has tried to understand the economic effect of pay disparity between managers and employees (Banker et al., 2016; Faleye et al., 2013; Firth et al., 2015), and has obtained divergent findings based on contrasting theories. This study addresses this issue by highlighting that comparison theories dominate SOE innovation and reduced pay disparity enhances employees' feelings of equity, promoting firm innovation. Moreover, my study showcases how to mitigate endogeneity concerns when establishing causal relationships between endogenous characteristics such as pay disparity and innovation. Certain unobservable factors related to the firm, managers or employees may concurrently affect pay disparity and innovation performance. To address such concerns, I use a quasi-natural experiment, enabled by the 2015 Reform, which generates exogenous variations in the pay disparity between managers and employees within SOEs. I further adopt the DID approach to examine the causal effect of pay disparity on innovation performance, which advances existing methodological limitations in pay disparity studies.

Lastly, my heterogeneity analyses (i.e., CEO and chairman duality, and independent directors) in the study further contribute to SOE innovation literature. Previous literature mainly focused on innovation variances between SOEs and non-SOEs (Clò et al., 2020; Lazzarini et al., 2021; Zhou et al., 2017), while only few articles examine the heterogeneities among SOEs in innovation, especially for SOEs' leadership heterogeneity.

By investigating the moderating effects of CEO and chairman duality and independent director ratio on the relationship between reduced pay disparity and innovation performance, I demonstrate the value of considering SOEs' leadership heterogeneity in understanding the variations in firm innovation.

4.2 Institutional Background and Hypothesis Development

4.2.1 Institutional background

In China, SOEs are an engine for economic development, accounting for approximately 28% of GDP from 2010 to 2020 (Zhang, 2023). SOEs are mainly distributed in strategically important industries for the national economy, including banking, energy, telecommunications, and transportation. Different from private firms, SOEs are established not only for commercial goals but also for addressing social and national demands, such as maintaining social stability, job creation, technological innovation and sustainable development (Lin et al., 1998; Xin et al., 2019). These enterprises often function with a certain level of government intervention and are subject to policy burdens (Huang et al., 2017; Lin et al., 1998).

On January 1, 2015, the Chinese government began implementing an important policy, the Reform Plan for the Executive Compensation in Central State-Owned Enterprises, which aims to make "downward adjustments" to executive compensation in central SOEs, leading to "a reasonable income distribution between managers and ordinary employees". The Reform has been widely recognized by the public as unprecedented and unexpected (Lin, 2017). Given the systematic requirements for SOEs' executive compensation reform, the 2015 Reform targeted central SOEs but also largely influenced local SOEs' executive compensation practices. As a result, the Reform generated exogenous variation (i.e., reduction) in pay disparity between managers and employees in SOEs.

The labor market for executives in Chinese SOEs is unique, and they operate as both businessmen and politicians (Hu & Xu, 2021). These executives often move across different SOEs or between SOEs and the government, making career advancements within a "closed system" (Chen et al., 2018; Xin et al., 2019). Unlike monetary rewards, which are mostly favored by other executives in the managerial labor market, SOE executives are more concerned about assessment by government officials and tend to prioritize political promotions and other intangible economic and social benefits over monetary rewards (Cao et al., 2019; Chen et al., 2013). Given incentives for executives and executives' behaviors are less affected by monetary compensations, I argue that the effect of reduced pay disparity should be attributed more to ordinary employees than to managers. In the next section, based on the comparison theories, I will theorize how the reduction in pay disparity affects employees' attitudes and behaviors toward innovation.

4.2.2 Hypothesis development

The comparison theories include equity theory and relative deprivation theory, focusing on the social comparison of rewards. Equity theory proposes that people believe that the level of individual distribution should be the basis of rewards distribution in social exchange relationships (Adams, 1965). Individuals judge the equity of their exchange relationships with their organizations by comparing the balance between contributed inputs and received outcomes to the input-outcome balances of their reference groups (Cowherd & Levine, 1992). When individuals perceive that their input-outcome ratio is similar to that of their comparative referents, they feel a sense of fairness, while dissimilar ratios can cause feelings of inequity (Cowherd & Levine, 1992). Relative deprivation theory states that individuals can experience deprivation when they compare their rewards to their reference groups' rewards and perceive that they have received less than they deserve (Martin, 1981). Research on relative deprivation suggests that lower-status

organization members will feel injustice when they compare their rewards to those received by upper-status members (Martin, 1981; Martin et al., 1987).

The comparison theories suggest that individuals will experience stronger feelings of inequity or deprivation if their input-outcome ratios are lower than those of their reference groups (Adams, 1965; Martin, 1981). In light of this, I expect that a large pay disparity between managers and employees would make employees perceive a high level of inequity. To reduce the tension caused by feelings of inequity, individuals may engage in some costly behavior, such as reducing their actual inputs (e.g., decreasing work effort), ending perceived inequitable relationships by leaving their organization, or even retaliating to the detriment of their own welfare (Cowherd & Levine, 1992). Such costly behavior is likely to impede firm innovation (Xu et al., 2017). Thus, I argue that reduced pay disparity can enhance employees' feelings of equity and reduce such costly behavior.

Moreover, stronger feelings of equity associated with reduced pay disparity can improve employees' job satisfaction and engagement (Adams, 1965; Fu et al., 2020; Kwon & Kim, 2020), fostering their positive attitudes and behavior toward innovation. Job satisfaction can improve employees' retention and motivation, to the benefit of shareholders, and encourage employees to create value by inventing new products or building client relationships (Edmans, 2011). Auer Antoncic and Antoncic (2011) suggested that employee satisfaction encourages organizational entrepreneurship, which is critical to firm innovation. Similarly, employee engagement is also expected to drive firm innovation via three aspects of engagement (i.e., cognitive, emotional, and physical engagement) (Kwon & Kim, 2020). Specifically, cognitive engagement encourages employees to reshape existing knowledge structures, broaden their cognition scope, and generate non-traditional ideas (Fredrickson, 2001). Emotional engagement inspires employees to believe in the meaningfulness of innovative efforts and adopt proactive

behaviors across the organization (Demerouti & Cropanzano, 2010; Shuck et al., 2017). As exhausted employees may lose intrinsic motivation to generate creative ideas and become disengaged from new initiatives (Kwon & Kim, 2020), physical engagement is also critical in sustaining innovative behavior (Shuck et al., 2017).

In summary, I argue that reduced pay disparity in SOEs can enhance employees' feelings of equity, which can reduce costly behaviors and increase job satisfaction and employee engagement, and thus promote firm innovation. Therefore, I propose a positive relationship between reduced pay disparity between managers and employees and SOE innovation performance as the following hypothesis:

H1: *Reduced pay disparities between managers and employees within SOEs lead to higher innovation performance.*

4.3 Research Methodology

4.3.1 Data and sample

This study adopted a DID approach to investigate the relationship between SOE pay disparity and innovation using a quasi-natural experiment created by the Reform, which has been enforced since 1 January 2015. In the sample, the treatment group includes all SOEs, and the control group comprises non-SOEs. This DID approach integrates a cross-sectional comparison with a time-series comparison, effectively addressing the endogeneity issues which might arise from omitted longitudinal trends or unobserved cross-sectional differences (Roberts & Whited, 2013).

I set the sample period as eight years prior to and eight years after the Reform's enforcement (i.e., 2007–2022). The initial sample included all Chinese A-share firms listed in the Shanghai and Shenzhen stock exchanges between 2007 and 2022. Following previous literature, to construct the sample, I excluded the following: (1) firms designated as special treatment (ST) or particular transfer (PT) by the China Securities Regulatory

Commission, (2) financial industry firms (e.g., banks, insurance companies, and investment trusts) due to their unique operating structures and financial reporting requirements compared to other firms, and (3) observations with missing values for the main variables. The final sample consisted of 31,707 firm-year observations, including 9,744 SOE firm-years and 21,963 non-SOE firm-years. To mitigate the influence of outliers, I winsorize all continuous variables in the top and bottom one percentile. Data on firms' basic information, financial information, and governance information were mainly collected from the China Stock Market & Accounting Research (CSMAR) database, supplemented by firms' annual reports. The patent data was obtained from the China National Intellectual Property Administration (CNIPA).

4.3.2 Variables

Dependent variable. *Innovation performance* is measured as the natural logarithm of one plus the total number of patents applied by firms in a given year, including invention patents, design patents, and utility model patents. Although the number of patents cannot fully capture a firm's innovation activity, using patent-based metrics to measure firm innovation prevails in recent research (Clò et al., 2020; Li et al., 2020; Xu et al., 2017).

Independent variables. *SOE dummy* equals 1 if the firm is actually controlled by the state, and zero otherwise. *Post* is also a dummy variable which equals 1 in the post-Reform period (after 2014, i.e., equal to or later than 2015), and zero otherwise. For SOEs, the indicator variable *SOE post event* is defined as one for the observation years after 2014 and zero otherwise. For non-SOEs, *SOE post event* is always defined as zero.

Control variables. Based on previous innovation literature, I control a vector of firm and industry characteristics which may affect innovation performance, including firm size, firm age, leverage, ROA, sale growth, fixed assets, R&D expenditure, CEO duality

dummy, independent director ratio, management holding ratio, and industry concentration. The detailed variable definitions are shown in Table 4.1.

4.3.3 Research design

To test the causal effect of pay disparity on innovation, I used the Reform in 2015 as an exogenous change in pay disparity to conduct the DID analysis following the OLS regression:

$$\text{LnPatent}_{i,t} = \alpha + \beta_1 SOE_{i,t} + \beta_2 SOE_{i,t} XPost_t + \gamma X_{i,t} + FirmFE + YearFE + \varepsilon_{i,t} \quad (1)$$

Where subscripts *i, t* denote firm and year, respectively; *X* represents a set of control variables; firm and year fixed effects are also included in the regression; ε is the standard error term calculated by clustering at the firm level. β_2 is the coefficient of interest for our study.

Table 4.1 Variable Measurements and Data Sources

Variables	Measurements	Data Sources
Dependent variable		
Innovation performance *(LnPatent)*	The natural logarithm of one plus the total number of patents applied by firms in a given year, including invention patents, design patents, and utility model patents.	CNIPA
Independent variable		
SOE post-event *(SOEXPost)*	A dummy variable which equals 1 for SOEs in the post-Reform period and 0 for SOEs before the Reform and all non-SOEs during the sample period.	CSMAR
SOE dummy *(SOE)*	A dummy variable which equals 1 if the firm is actually controlled by the state and 0 otherwise.	CSMAR
Post *(Post)*	A dummy variable which equals 1 in the post-Reform period and 0 otherwise.	CSMAR
Control variables		
Firm size *(Firm size)*	The natural logarithm of one plus the amount of total assets.	CSMAR
Firm age *(Firm age)*	The number of years since the firm's establishment.	CSMAR
Leverage *(Leverage)*	Total liabilities divided by total assets.	CSMAR
ROA *(ROA)*	Net profits divided by total assets.	CSMAR
Sales growth *(Sales growth)*	Sales growth rate over the previous year.	CSMAR
Fixed assets *(Fixed assets)*	Fixed assets divided by total assets.	CSMAR
R&D expenditure *(R&D)*	R&D expenditures divided by total assets.	CSMAR
CEO duality dummy *(Duality)*	A dummy variable which equals 1 if the CEO also serves as the board chair in a given year and 0 otherwise.	CSMAR
Independent director ratio *(IndRatio)*	The ratio of independent directors on the board.	CSMAR
Management holding ratio *(Management holding)*	The management shareholding ratio of the firm.	CSMAR
Industry concentration *(HHI)*	The Herfindahl index, calculated at the three-digit industry level.	CSMAR

4.4 Empirical Results

4.4.1 Descriptive statistics and correlations

Table 4.2 presents the descriptive statistics and correlations of the variables used in the analysis ($N = 31{,}707$). On average, the sample firms applied for 16.7 patents per year. The mean value of *SOE* is 0.31, indicating that SOE observations account for 31% of total samples. The mean value of the policy indicator variable (*SOEXPost*) is 0.2, indicating that 20% of the observations in the sample are affected by the Reform during the sample period. A review of correlations suggests that multicollinearity among the explanatory variables is not a major concern in the sample, since the maximum variance inflation factor (VIF) is 2.83 (for *SOE*) and the mean VIF is 1.48, which is significantly below the rule-of-thumb cutoff of 10 for regression models (Ryan, 1997).

4.4.2 Baseline results

Table 4.3 presents the baseline regression results of Eq. (1). The findings show that compared with non-SOEs, patent applications increased significantly in SOEs post-Reform ($\beta_2 = 0.141, t = 3.301$). This suggests that reduced pay disparity promotes innovation performance as reflected in a firm's patents, supporting the comparison theories. In terms of economic significance, LnPatent for SOEs increased by 8.9% of one standard deviation after the Reform. With regards to control variables, firms that are of larger size, or with more fixed assets and more R&D expenditure, filed more patent applications.

4.4.3 Robustness tests

In this section, I describe the robustness tests I conducted, including the parallel trend test, placebo test, adopting entropy balancing technique, and using an alternative proxy for innovation performance.

Parallel trend test. The validity of the DID approach critically depends on the parallel trend assumption that innovation activities among SOEs (i.e., treatment group) and non-SOEs (i.e., control group) would have behaved similarly in the absence of the treatment (i.e., the implementation of the Reform in 2015). Therefore, I followed the method of Bertrand and Mullainathan (2003) to test the parallel trend assumption (e.g., Fang et al., 2017; Tan et al., 2020). Specifically, I estimated the following model:

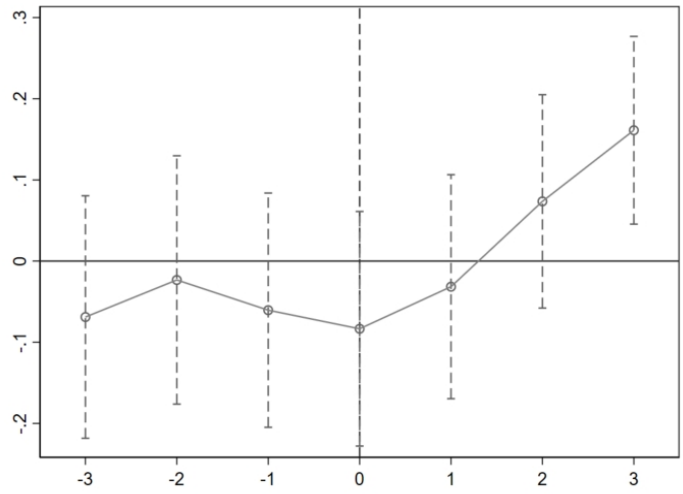
$$\text{LnPatent}_{i,t} = \alpha + \beta_1 SOE_{i,t} XBefore3^{+}{}_t + \beta_2 SOE_{i,t} XBefore2_t + \beta_3 SOE_{i,t} XBefore1_t + \beta_4 SOE_{i,t} XCurrent0_t + \beta_5 SOE_{i,t} XAfter1_t + \beta_6 SOE_{i,t} XAfter2_t + \beta_7 SOE_{i,t} XAfter3^{+}{}_t + \gamma X_{i,t} + FirmFE + YearFE + \varepsilon_{i,t} \quad (2)$$

$Before3^{+}{}_t$ is a dummy variable which equals 1 if the observation is at least three years before the Reform implementation, and zero otherwise. $Before2_t$ and $Before1_t$ are also dummy variables which equal 1 if the observation is two years and one year before the Reform implementation, and zero otherwise, respectively. $Current0_t$ equals 1 if the observation is in the Reform year (i.e., 2015), and zero otherwise. Similarly, $After1_t$ and $After2_t$, are dummy variables which equal 1 if the observation is the first and second year after the Reform, and zero otherwise, respectively. $After3^{+}{}_t$ equals 1 for all years starting from the third year after the Reform, and zero otherwise. All other variables have the same definitions as in Eq. (1).

Table 4.4 reports the results estimating Eq. (2). The coefficient estimates on β_1, β_2 and β_3 are statistically insignificant and economically negligible, indicating that SOEs and non-SOEs did not exhibit significantly different trends in innovation performance before the Reform. In contrast, I found that the coefficient estimate on β_7 is positive and significant, but the coefficient estimates on β_4, β_5 and β_6 are not, suggesting that the inducement effect of the Reform on innovation performance has occurred since the third year after the Reform, suggesting a long-term impact of the Reform. Figure 4.1 also shows

the results of the parallel trend test. Overall, the results satisfy the parallel trend assumption and are consistent with the results for Eq. (1).

Figure 4.1 Parallel Trend



Placebo test. I conducted a placebo test to address the concern that the DID results could have been driven by chance instead of the Reform implementation. Specifically, 1000 random false experiments were conducted with replacement sampling, and the coefficients and t-statistics of all regression results were analyzed. Table 4.5 summarizes the distribution of the simulated DID estimates (i.e., the coefficient estimates of *SOEXPost*) and the distribution of the corresponding t-statistics. Compared to the coefficient of *SOEXPost* in Table 4.3, as shown in Table 4.5, in the 1000 simulations, all coefficients of *SOEXPost* are smaller, while only one t-statistic is higher than the baseline. Therefore, these results indicate that the baseline results are unlikely to be driven by chance or unobserved event shocks.

Entropy balancing technique. As mentioned above, I used SOEs and non-SOEs as the treatment and control groups in the DID model, respectively. One major concern was the possible systematic differences between these two groups, which can drive the results. Thus, to address this concern, I adopted an entropy balancing technique, which is a

preprocessing technique to achieve covariate balance within a binary treatment (Hainmueller, 2012). I constructed an entropy-balanced sample on the first and second order moments between SOEs and non-SOEs, and the covariates included all control variables in Eq. (1). Panel A in Table 4.6 reports the balancing tests and shows that the significantly different covariates between the treatment and control groups become insignificant after entropy balancing. It suggests that the covariates between SOEs and non-SOEs are well balanced. Then I re-ran the DID model in Eq. (1) using the balanced sample. Panel B in Table 4.6 reports the regression results. Consistent with the baseline results, the significantly positive coefficient on *SOEXPost* indicates the Reform's relation to increased innovation performance.

Alternative measure for innovation performance. In the final robust tests, I used *LnInvention* as an alternative measure of innovation performance, which is defined as the natural logarithm of one plus the number of invention patents applied by firms in a given year. Among all three different types of patents (i.e., invention, utility, and design patents), invention patents are of the highest novelty and technological inventiveness (Li et al., 2020). For an invention to be granted, the application must meet strict criteria of novelty, inventiveness, and practical applicability. Thus, the number of invention patents serves as a strong indicator of a firm's high-level innovation capability. Table 4.7 reports the regression results using this alternative measure. Consistent with the baseline results, the coefficient on *SOEXPost* is significantly positive.

4.4.4 Possible underlying mechanisms

The above empirical results have suggested that there is a positive causal link between the Reform and innovation performance. In this section, I will explore plausible underlying mechanisms through which the Reform promotes innovation performance. I

hypothesize the enhancing effect of the Reform on innovation due to two possible mechanisms: more equity feelings of ordinary employees and more risk-taking of the firm.

First, according to equity and relative deprivation theories (Adams, 1965; Cowherd & Levine, 1992; Martin, 1981), individuals' feelings of inequity or deprivation would be stronger when they find that their rewards are fewer than they deserve compared to their reference group, which may lead to costly behavior that impedes firm innovation. I expect the Reform can improve the feelings of equity of ordinary employees and, thus, promote firm innovation performance. To validate this mechanism, I use three proxies to proxy employees' feelings of equity: *Pay ratio_All*, *Pay ratio_Top3*, and *Managers salary*. First, *Pay ratio_All* is the ratio of average compensation for all managers to average pay of ordinary employees. Second, *Pay ratio_Top3* refers to the average compensation for the top three highest-paid managers divided by average pay of ordinary employees. Third, *Managers salary* is defined as the natural logarithm of one plus total compensation for all managers. Table 4.8 presents the results and shows that the coefficients of *SOEXPost* in Models (1), (2) and (3) are all significantly negative, indicating that the Reform significantly reduced the feelings of inequity of ordinary employees.

Second, reduced pay disparity may incentivize firms to take more risks, such as investing in innovation and, thus, enhance innovation performance. To test this mechanism, I use *R&D investment* as the proxy for a firm's risk-taking, which is defined as the natural logarithm of one plus the amount of a firm's R&D expenditure in a given year. Model (4) in Table 4.8 reports the result, which is consistent with this mechanism; the coefficient of *SOEXPost* is significantly positive.

4.4.5 Heterogeneity analyses

In this section, I examine how the heterogeneities of corporate governance, industry concentration, and institutional development influence the impact of the Reform on innovation performance.

Corporate governance. The non-dual CEO (i.e., the CEO does not serve as the chairperson of the board simultaneously) and independent directors can improve corporate governance efficiency and promote risk-taking of firm strategy, and thus enhance firm innovation (Jiraporn et al., 2018; Krause et al., 2013). According to this, I propose that the Reform's impact would be stronger in SOEs with better governance, reflected in a non-dual CEO and high independent ratio of the board. *CEO duality* equals 1 if the CEO also serves as the board chair, and zero otherwise. *Independent director ratio* refers to the ratio of independent directors on the board. Table 4.9 reports the regression results and shows that the coefficient of *SOEXPost* is significantly positive in Models (1) and (4), but not significant in Models (2) and (3). It indicates that the inducing effect of the Reform on innovation is only significant in SOEs with the non-dual CEO and high independent director ratio.

Industry concentration. Compared with SOEs in the industry with high competition, the pay disparity between managers and ordinary employees of SOEs in monopoly industries could be much larger, where employees may have stronger feelings of inequity. Therefore, I hypothesize that industry concentration can strengthen the enhancing effect of the Reform on innovation performance. Following Zhou et al. (2017), I use the Herfindahl index to measure *industry concentration*, calculated at the three-digit industry level for each year, using sales revenue and market share of each firm within the industry. Table 4.10 shows the results. Consistent with my hypothesis, the coefficient of *SOEXPost* is only significant in Model (2) when the industry concentration is high.

Institutional development. In a region with less-developed institutional development, the pay disparity in SOEs could be larger and ordinary employees develop stronger feelings of inequity. Thus, I expect that the effect of the Reform might be stronger in regions with less-developed institutional development. Following Fan et al. (2011), I employ a composite Marketization Index to measure provincial *institutional development* for each firm's headquarter location. I obtain the data of this index from the National Economic Research Institute (NERI). The results shown in Table 4.11 indicate that the coefficient of *SOEXPost* is significant in Model (1) but insignificant in Model (2), supporting my expectation.

Table 4.2 Descriptive Statistics and Correlations

Variable	Obs	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13
1. LnPatent[a]	31,707	2.88	1.59													
2. SOEXPost	31,707	0.20	0.40	0.15												
3. SOE	31,707	0.31	0.46	0.09	0.74											
4. Firm size[a]	31,707	22.07	1.29	0.42	0.37	0.37										
5. Firm age	31,707	18.55	6.03	0.10	0.32	0.16	0.24									
6. Leverage[b]	31,707	0.40	0.21	0.16	0.21	0.31	0.48	0.16								
7. ROA[b]	31,707	0.04	0.07	0.05	-0.08	-0.09	-0.01	-0.10	-0.38							
8. Sale growth[b]	31,707	0.18	0.42	0.03	-0.05	-0.05	0.04	-0.07	0.02	0.25						
9. Fixed assets[b]	31,707	0.21	0.15	-0.04	0.10	0.19	0.13	0.01	0.16	-0.09	-0.05					
10. R&D[b]	31,707	0.02	0.02	0.23	-0.11	-0.19	-0.18	-0.04	-0.20	0.10	0.02	-0.21				
11. Duality	31,707	0.31	0.46	-0.03	-0.23	-0.31	-0.18	-0.09	-0.15	0.04	0.02	-0.11	0.13			
12. IndRatio[b]	31,707	0.38	0.05	0.02	-0.03	-0.07	0.00	0.01	-0.01	-0.02	-0.01	-0.05	0.04	0.11		
13. Management holding[b]	31,707	0.16	0.21	-0.06	-0.35	-0.48	-0.36	-0.23	-0.34	0.16	0.05	-0.19	0.19	0.25	0.08	
14. HHI[b]	31,707	0.09	0.10	-0.08	0.05	0.09	0.09	-0.04	0.08	-0.04	-0.01	0.04	-0.21	-0.05	0.00	-0.07

[a]Natural Logarithm.
[b]Percentage.

Table 4.3 Baseline Results

	LnPatent
SOEXPost	0.141***
	(3.301)
SOE	-0.021
	(-0.303)
Firm size	0.602***
	(23.529)
Firm age	0.022
	(0.753)
Leverage	-0.126
	(-1.428)
ROA	0.111
	(0.856)
Sale growth	-0.015
	(-0.936)
Fixed assets	0.258**
	(2.242)
R&D	10.970***
	(12.314)
Duality	0.061**
	(2.564)
IndRatio	-0.184
	(-0.877)
Management holding	0.164
	(1.533)
HHI	-0.295*
	(-1.768)
Constant	-11.045***
	(-13.891)
Firm	YES
Year	YES
No. observation	31707
Adj R-squared	0.727
Prob > F	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.4 Parallel Trend Tests

	LnPatent
SOEXBefore3+	-0.069
	(-0.905)
SOEXBefore2	-0.023
	(-0.298)
SOEXBefore1	-0.060
	(-0.822)
SOEXCurrent0	-0.083
	(-1.132)
SOEXAfter1	-0.032
	(-0.448)
SOEXAfter2	0.074
	(1.097)
SOEXAfter3+	0.161***
	(2.732)
Firm size	0.605***
	(23.675)
Firm age	0.027
	(0.933)
Leverage	-0.106
	(-1.198)
ROA	0.074
	(0.571)
Sale growth	-0.018
	(-1.099)
Fixed assets	0.273**
	(2.360)
R&D	11.028***
	(12.415)
Duality	0.059**
	(2.490)
IndRatio	-0.198
	(-0.946)
Management holding	0.114
	(1.052)
HHI	-0.290*
	(-1.747)
Constant	-11.204***
	(-14.073)
Firm	YES
Year	YES
No. observation	31707
Adj R-squared	0.727
Prob > F	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.5 Placebo Tests

Variable	Mean	SD	Min	Median	Max
beta	0.000	0.012	-0.039	0.000	0.045
t	0.006	0.982	-3.131	0.002	3.694
N(|*beta*| >= 0.141)	0				
N(|*t*| >= 3.301)	1				

Note: The descriptive statistics of the coefficient *beta* and *t*-statistics of *SOEXPost* from the simulations are reported in this table. *N*(|*beta*| >= 0.141) indicates the number of times the absolute value of coefficient of *SOEXPost* is more than 0.141 in 1000 simulations. *N*(|*t*| >= 3.301) indicates the number of times the absolute value of t-statistic of *SOEXPost* is more than 3.301 in 1000 simulations.

Table 4.6 Entropy Balancing Technique

Panel A Balancing tests

	SOE			Non-SOE (Before balancing)			Non-SOE (After balancing)		
	Mean	Variance	Skewness	Mean	Variance	Skewness	Mean	Variance	Skewness
Firm size	22.780	2.129	0.503	21.760	1.125	0.772	22.780	2.129	0.443
Firm age	19.990	36.950	-0.001	17.900	34.780	0.164	19.990	36.950	0.012
Leverage	0.500	0.041	0.023	0.361	0.037	0.586	0.500	0.041	0.058
ROA	0.030	0.004	-1.433	0.044	0.005	-1.895	0.030	0.004	-1.254
Sale growth	0.150	0.174	4.170	0.193	0.173	3.291	0.150	0.174	3.400
Fixed assets	0.247	0.030	0.754	0.188	0.016	0.826	0.247	0.030	0.558
R&D	0.017	0.000	1.944	0.026	0.000	1.818	0.017	0.000	1.996
Duality	0.099	0.089	2.681	0.406	0.241	0.383	0.099	0.089	2.681
IndRatio	0.370	0.003	1.694	0.378	0.003	0.926	0.370	0.003	1.414
Management holding	0.009	0.001	6.429	0.225	0.047	0.530	0.009	0.001	11.820
HHI	0.100	0.012	3.465	0.080	0.009	4.030	0.100	0.012	3.485

Panel B Balanced sample

	LnPatent
SOEXPost	0.245***
	(3.525)
SOE	-0.099
	(-1.119)
Firm size	0.471***
	(10.436)
Firm age	0.028
	(0.377)
Leverage	-0.078
	(-0.549)
ROA	0.180
	(0.754)
Sale growth	0.033
	(1.244)
Fixed assets	0.120
	(0.599)
R&D	11.668***
	(6.936)
Duality	0.112***
	(2.790)
IndRatio	-0.017
	(-0.058)
Management holding	0.538
	(1.385)
HHI	-0.237
	(-0.970)
Constant	-8.489***
	(-4.537)
Firm	YES
Year	YES
No. observation	31707
Adj R-squared	0.773
Prob > F	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.7 Alternative Measure of Innovation Performance

	LnInvention
SOEXPost	0.131***
	(3.381)
SOE	-0.029
	(-0.435)
Firm size	0.571***
	(23.795)
Firm age	-0.005
	(-0.167)
Leverage	-0.084
	(-1.089)
ROA	0.052
	(0.442)
Sale growth	-0.032**
	(-2.169)
Fixed assets	0.117
	(1.114)
R&D	11.486***
	(13.483)
Duality	0.047**
	(2.089)
IndRatio	-0.003
	(-0.018)
Management holding	0.172*
	(1.757)
HHI	-0.173
	(-1.158)
Constant	-10.808***
	(-13.511)
Firm	YES
Year	YES
No. observation	31707
Adj R-squared	0.717
Prob > F	0.000

Note: *t*-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.8 Mechanism Tests

	Model 1	Model 2	Model 3	Model 4
	Pay ratio_All	Pay ratio_Top3	Managers salary	R&D investment
SOEXPost	-0.214*	-0.590***	-0.135***	0.192***
	(-1.775)	(-2.712)	(-6.400)	(4.848)
SOE	0.238	0.199	0.118***	-0.194***
	(1.141)	(0.471)	(3.256)	(-3.078)
Firm size	0.954***	1.910***	0.287***	0.798***
	(11.486)	(12.396)	(21.957)	(34.224)
Firm age	-0.123	-0.239	0.021	-0.024
	(-0.791)	(-0.841)	(1.475)	(-0.662)
Leverage	-0.423*	-0.912**	-0.080*	-0.404***
	(-1.920)	(-2.330)	(-1.957)	(-5.204)
ROA	4.172***	6.823***	0.788***	0.452***
	(11.161)	(10.003)	(13.155)	(4.299)
Sale growth	-0.123***	-0.181**	-0.042***	0.001
	(-2.865)	(-2.427)	(-4.582)	(0.070)
Fixed assets	-0.307	-0.336	-0.154***	0.457***
	(-0.999)	(-0.589)	(-2.827)	(3.530)
R&D	8.292***	17.510***	4.343***	/
	(3.448)	(4.109)	(10.331)	/
Duality	-0.049	-0.233*	-0.044***	0.019
	(-0.794)	(-1.901)	(-4.055)	(0.956)
IndRatio	0.623	-0.435	-0.702***	0.010
	(1.029)	(-0.386)	(-6.818)	(0.060)
Management holding	-0.040	0.081	0.154***	0.515***
	(-0.121)	(0.128)	(2.865)	(5.453)
HHI	0.497	1.048	0.165**	0.010
	(1.087)	(1.150)	(2.036)	(0.059)
Constant	-14.258***	-29.784***	8.739***	0.555
	(-4.158)	(-4.677)	(22.854)	(0.672)
Firm	YES	YES	YES	YES
Year	YES	YES	YES	YES
No. observation	29191	29198	31670	31707
Adj R-squared	0.688	0.693	0.801	0.849
Prob > F	0.000	0.000	0.000	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.9 Corporate Governance Heterogeneity

	Model 1	Model 2	Model 3	Model 4
	CEO duality		Independent director ratio	
	Duality=0	Duality=1	Low	High
SOEXPost	0.121**	-0.117	0.062	0.197***
	(2.544)	(-0.840)	(1.099)	(3.019)
SOE	-0.012	0.187	0.035	-0.070
	(-0.161)	(1.008)	(0.371)	(-0.631)
Firm size	0.597***	0.637***	0.553***	0.623***
	(18.479)	(13.941)	(14.352)	(17.245)
Firm age	0.019	0.070*	0.047	0.030
	(0.655)	(1.678)	(0.863)	(1.028)
Leverage	-0.160	-0.004	0.053	-0.196
	(-1.489)	(-0.023)	(0.438)	(-1.522)
ROA	0.084	-0.001	0.315*	-0.167
	(0.510)	(-0.004)	(1.711)	(-0.939)
Sale growth	0.004	-0.073**	-0.024	-0.003
	(0.199)	(-2.459)	(-1.136)	(-0.107)
Fixed assets	0.249*	0.231	0.068	0.353**
	(1.755)	(1.213)	(0.425)	(2.139)
R&D	11.389***	11.117***	11.221***	10.743***
	(9.849)	(9.045)	(8.627)	(9.212)
Duality	/	/	0.046	0.075**
	/	/	(1.310)	(2.264)
IndRatio	-0.064	-0.415	/	/
	(-0.254)	(-1.058)	/	/
Management holding	0.268**	-0.195	0.129	0.187
	(1.983)	(-1.168)	(0.753)	(1.418)
HHI	-0.305	-0.089	-0.001	-0.394*
	(-1.545)	(-0.334)	(-0.002)	(-1.893)
Constant	-10.981***	-12.380***	-10.566***	-11.702***
	(-11.866)	(-10.044)	(-7.857)	(-12.391)
Firm	YES	YES	YES	YES
Year	YES	YES	YES	YES
No. observation	21666	9548	15546	15478
Adj R-squared	0.740	0.733	0.729	0.745
Prob > F	0.000	0.000	0.000	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.10 Industry Concentration Heterogeneity

	Model 1	**Model 2**
	Low	High
SOEXPost	0.046	0.164***
	(0.749)	(2.753)
SOE	0.054	-0.021
	(0.611)	(-0.190)
Firm size	0.651***	0.579***
	(19.385)	(14.317)
Firm age	0.004	0.026
	(0.131)	(0.387)
Leverage	-0.189*	-0.070
	(-1.786)	(-0.537)
ROA	0.062	0.091
	(0.372)	(0.459)
Sale growth	-0.017	-0.021
	(-0.805)	(-0.810)
Fixed assets	0.104	0.322*
	(0.700)	(1.759)
R&D	9.872***	13.062***
	(9.606)	(7.504)
Duality	0.067**	0.035
	(2.122)	(0.969)
IndRatio	-0.265	-0.100
	(-1.005)	(-0.329)
Management Holding	0.006	0.195
	(0.045)	(1.110)
Constant	-11.484***	-10.928***
	(-12.639)	(-6.935)
Firm	YES	YES
Year	YES	YES
No. observation	15743	15638
Adj R-squared	0.740	0.730
Prob > F	0.000	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

Table 4.11 Institutional Development Heterogeneity

	Model 1	Model 2
	Low	High
SOEXPost	0.145**	0.070
	(2.539)	(0.933)
SOE	-0.016	0.091
	(-0.179)	(0.875)
Firm size	0.598***	0.591***
	(16.515)	(15.578)
Firm age	-0.026	-0.004
	(-0.382)	(-0.102)
Leverage	0.080	-0.349***
	(0.604)	(-2.964)
ROA	0.522**	-0.221
	(2.476)	(-1.442)
Sale growth	-0.022	-0.004
	(-1.002)	(-0.146)
Fixed assets	0.041	0.291*
	(0.251)	(1.721)
R&D	11.190***	10.165***
	(8.246)	(8.977)
Duality	0.063*	0.052
	(1.713)	(1.579)
IndRatio	-0.271	-0.136
	(-0.933)	(-0.436)
Management Holding	0.229	0.212
	(1.251)	(1.472)
HHI	-0.310	0.112
	(-1.266)	(0.412)
Constant	-10.223***	-10.171***
	(-7.079)	(-9.151)
Firm	YES	YES
Year	YES	YES
No. observation	15354	15642
Adj R-squared	0.738	0.744
Prob > F	0.000	0.000

Note: t-statistics are reported in parentheses. *p<0.1; **p<0.05; ***p<0.01.

4.5 Discussion and Conclusions

Building on comparison theories, the pay disparity literature and SOE innovation literature, I investigate the causal effect of reduced pay disparity between managers and employees on SOE's innovation performance. Using a quasi-natural experiment enabled by China's 2015 pay-cut regulation for SOE executives and a sample of listed Chinese firms from 2007 to 2022, I adopted a DID approach to estimate such a causal effect. The result shows a significantly positive relationship between reduced pay disparities in SOEs and innovation performance; further, the robustness tests, including the parallel trend test, the placebo test, adopting an entropy balancing technique, and using alternative measures for innovation performance, support the baseline result. Furthermore, the mechanism test proves the enhancing effect of reduced pay disparity on employees' feelings of equity. In addition, my heterogeneity analyses discover that the corporate governance quality (i.e., non-dual CEO and independent director ratio) and industry concentration strengthen the positive effect of the reduced pay disparity on innovation, while it is the opposite for regional institutional development. These findings contribute to the existing literature in the following ways.

First, I contribute to SOE innovation literature by highlighting the impact of government efforts to reduce pay inequity between managers and employees on SOE innovation performance. Previous studies mainly discussed how the government changes ownership structure via state ownership, influencing SOE innovation (Jia et al., 2019; Zhou et al., 2017). State ownership is a double-edged sword in firm innovation. On the one hand, state ownership can impede innovation by causing the dual agency problem in SOEs (Chang et al., 2019; Zhou et al., 2017). On the other hand, through state ownership, firms can easily obtain key innovation resources from the government, such as financial support and intellectual property right (IPR) protection, which are important for SOE

innovation (Bruton et al., 2015; Yi et al., 2017). However, scholars have ignored the important role of government in influencing SOEs' compensation practices, another important corporate governance mechanism driving firm innovation. By adopting a quasi-natural experiment enable by the China 2015 Reform, my results support that the government's effort to reduce pay disparity between managers and employees can significantly improve firm innovation performance by enhancing employees' feelings of equity. These findings broaden our understanding of the government's role in shaping SOEs' corporate governance and innovation, which has significant practical implications regarding inspiring employees' innovative attitudes and behaviors to build SOEs' innovative capabilities.

Second, I contribute to pay disparity studies theoretically and empirically by focusing on the innovation implications of pay disparity in SOEs and using a quasi-natural experiment. Scholars have examined the economic effect of pay disparity with contrasting views. One main literature stream supports tournament theory and suggests the positive effect of pay disparity on firm performance (Kale et al., 2009; Lallemand et al., 2004; Lee et al., 2008). In contrast, another literature stream based on comparison theories proposes that increased pay gaps in organizations are related to higher managerial turnover, less collaboration and lower productivity (Bloom & Michel, 2002; Firth et al., 2015). Notably, few studies have paid attention to the implications of pay disparity on innovation. For instance, based on tournament theory, the pay gap between managers and ordinary employees (Xu et al., 2017), and the pay disparity between CEO and non-CEO executives (Zhong et al., 2022), have positive effects on firm innovation performance. Nevertheless, these studies did not consider an important but ignored cohort, that is, SOEs. My study, based on comparison theories, confirms the enhancing effect of reduced pay disparity on SOEs' innovation performance. The findings indicate that firm ownership, especially

state ownership, does matter in resolving the debate about pay disparity impact, supplementing our knowledge on the role of pay disparity in firm innovation. Moreover, my study provides a promising but underexplored approach to mitigating endogeneity concerns and establishing a causal relationship between pay disparity and innovation performance. Existing studies often use instrument variables and 2SLS regressions to identify the causality related to pay disparity and firm outcomes (Xu et al., 2017). By adopting a quasi-natural experiment and a DID model with comprehensive robustness tests, I contribute to advancing the methodological applications in pay disparity studies and add empirical rigor to estimating the causal effects of the pay disparity and innovation relationship.

Finally, the heterogeneity analyses on CEO and chairman duality, and independent direct ratio, further contribute to SOE innovation literature. Previous scholars pay exclusive attention to comparing SOEs and non-SOEs in innovation variances, obtaining inconsistent views on whether SOEs innovate less than non-SOEs (Clò et al., 2020; Lazzarini et al., 2021; Zhou et al., 2017). However, few studies examine the heterogeneities among SOEs, especially regarding SOEs' leadership heterogeneity. In this study, I find that the enhancing effect of reduced pay disparity on innovation performance is more significant when there is no CEO and chairman duality in an SOE and when an SOE's board has a high ratio of independent directors, which highlights the value of considering SOEs' leadership heterogeneity in understanding the role of pay disparity in innovation.

Practical implications. Aside from theoretical contributions, my study also offers important implications for managers and policymakers in promoting firm innovation. The reduced pay disparities between managers and employees in SOEs improve firm innovation performance, and the positive effect of reduced pay disparity is more

significant in SOEs without CEO and chairman duality, with a high ratio of independent directors in the board, in industries with high concentration, and in regions with low level of institutional development. To improve technological innovation performance in SOEs, policymakers should pay attention to the pay disparity between managers and employees and try to reduce it when necessary. Especially, high industry concentration and low level of institutional development might increase income disparity between SOE managers and ordinary employees, which can exacerbate employees' feelings of inequality. Thus, policymakers and SOEs should focus more on reducing pay disparities within SOEs in monopoly industries and less developed regions. Moreover, non-dual CEOs and higher independent director ratios help make employees feel treated equally in SOEs, which can encourage innovation. For SOE managers to incentivize employees' creativity and innovation activities, they should be aware of the pay disparity structure within SOEs and take measures to address feelings of unfairness among employees arising from pay disparity.

Limitations and future research. This study is subject to several limitations, which provide opportunities for future research. First, I propose that the underlying mechanism through which reduced pay disparity promotes innovation performance could be enhancing employees' feelings of equity. To test this, I used three measures to proxy the feelings of equity. However, due to data limitations, I am not able to directly measure employees' feelings of equity to test the underlying mechanism. Future research could use the questionnaires to measure the feelings of equity directly. Second, this study uses the unique China Reform as research context, but the research question is generalizable. Thus, future research could explore pay disparities in SOEs across diverse contexts, comparing findings with my study, and potentially generate novel insights.

Appendices

Appendix A1 Centrality Measures for Bibliometric Coupling Analysis

Author	Cluster	Citation	Closeness centrality	Betweenness centrality	DOI
Zhou (2017)	1	294	0.50	543.73	10.1177/0001839216674457
Liu (2017)	1	155	0.35	1.71	10.5465/amj.2015.0230
Jefferson (2006)	1	97	0.33	0.00	10.1016/j.jce.2005.11.008
Jia (2019)	1	81	0.46	137.34	10.5465/amj.2016.0543
Sun (2000)	1	61	0.27	0.00	10.1080/00343400050058693
Tihanyi (2019)	1	41	0.47	238.85	10.1177/0149206318822113
Belloc (2014)	1	36	0.45	292.45	10.2753/jei0021-3624480311
Liao (2019)	1	30	0.32	0.72	10.1002/csr.1677
Xiao (2012)	1	30	0.27	0.00	10.1016/j.jimonfin.2012.01.006
Song (2015)	1	28	0.40	7.46	10.1016/j.ijresmar.2015.03.005
Tonurist (2015)	1	26	0.41	47.17	10.1016/j.technovation.2014.08.001
Kroll (2019)	1	20	0.47	310.66	10.1080/13662716.2018.1456323
Wu (2020)	1	20	0.42	132.55	10.1016/j.jclepro.2020.121157
Genin (2021)	1	19	0.40	8.64	10.1057/s41267-020-00342-w
Fu (2014)	1	17	0.32	13.32	10.1162/asep_a_00289
Howell (2020)	1	14	0.47	284.99	10.1080/00343404.2019.1659505
Clo (2020)	1	13	0.49	315.44	10.1016/j.respol.2020.103960
Lazzarini (2021)	1	13	0.48	266.86	10.1057/s41267-020-00327-9
Sun (2021)	1	13	0.44	122.70	10.1057/s41267-020-00340-y
Pan (2020)	1	13	0.40	59.62	10.1002/bse.2358
Bu (2020)	1	12	0.41	11.34	10.1002/sej.1358
Zhang (2021B)	1	12	0.40	38.69	10.1007/s10551-020-04553-x
Rodriguez-Pose (2020)	1	12	0.40	59.65	10.1016/j.techfore.2020.119937
Dai (2020)	1	11	0.36	14.85	10.1016/j.indmarman.2019.08.002
Gao (2019)	1	8	0.37	372.14	10.1080/13662716.2017.1415134
Benassi (2019)	1	8	0.42	23.82	10.1080/13662716.2018.1529554
Wang (2019B)	1	7	0.42	47.21	10.1111/caim.12305
Chang (2019)	1	6	0.45	176.53	10.1016/j.indmarman.2019.04.004
Gershman (2019)	1	6	0.35	23.05	10.1080/13662716.2018.1496815
Landoni (2020)	1	5	0.52	460.89	10.1016/j.strueco.2020.01.001
Iqbal (2022)	1	5	0.44	269.03	10.1108/ejim-04-2020-0161
Yang (2018)	1	5	0.32	0.00	10.1007/s00181-017-1292-8
Wang (2021D)	1	4	0.42	79.81	10.1007/s10961-020-09822-5
Davids (2009)	1	3	0.27	0.00	10.1080/00076790903125537
Poczter (2017)	1	2	0.42	155.30	10.1007/s10490-016-9475-y
Tan (2001)	2	169	0.27	2.63	10.1016/s0883-9026(99)00056-7
Wu (2016)	2	116	0.33	1.19	10.1016/j.jwb.2015.09.002
White (2000)	2	98	0.31	23.09	10.2307/1556398
Li (2011)	2	94	0.36	339.15	10.1016/j.worlddev.2010.05.011
Hu (2004)	2	66	0.26	0.00	10.1016/s1043-951x(03)00028-2
Yi (2017)	2	53	0.44	163.33	10.1016/j.technovation.2017.04.002
Tan (2005)	2	48	0.35	66.32	10.1016/j.jbusvent.2004.09.002
Xu (2008)	2	46	0.30	0.00	10.1007/s10490-008-9093-4
Li (2007)	2	45	0.32	32.17	10.1007/s10961-006-9009-8
Wang (2015)	2	39	0.37	4.37	10.1016/j.jbusres.2014.08.002
White (2008)	2	37	0.41	196.43	10.1111/j.1740-8784.2008.00107.x
Xia (2017)	2	23	0.42	91.26	10.1057/s41267-017-0083-y
Gao (2015)	2	18	0.41	104.09	10.1016/j.jbusres.2014.11.011
Li (2017)	2	16	0.31	6.99	10.1016/j.jmacro.2017.04.005
Yang (2012)	2	16	0.26	0.00	10.1080/19761597.2012.741393
Li (2016)	2	12	0.36	18.63	10.1007/s10490-015-9451-y
Chen (2020)	2	9	0.41	88.83	10.1109/tem.2018.2889804
Shen (2019)	2	4	0.39	1.77	10.1108/jmtm-10-2018-0352
Yi (2020)	2	3	0.44	163.33	10.1016/j.technovation.2019.102095
Gao (2014)	2	3	0.41	123.01	10.5172/impp.2014.16.1.106
Deng (2022)	2	2	0.26	0.00	10.1108/ejim-07-2020-0269
Lin (2010)	3	125	0.41	29.68	10.1016/j.jdeveco.2009.04.006
Fang (2017)	3	102	0.33	0.00	10.1093/rfs/hhx023
Wei (2017)	3	95	0.31	0.00	10.1257/jep.31.1.49
Guariglia (2014)	3	86	0.32	10.86	10.1016/j.irfa.2014.01.005
Rong (2017)	3	75	0.48	728.32	10.1016/j.respol.2017.05.013

Yuan (2018)	3	62	0.34	0.14	10.1016/j.jcorpfin.2017.12.015
Jia (2017)	3	26	0.42	116.16	10.1016/j.chieco.2017.08.012
Hao (2018)	3	26	0.35	3.58	10.1111/fima.12188
Yu (2021)	3	23	0.35	53.73	10.1016/j.enpol.2021.112255
Zeng (2011)	3	23	0.33	0.00	10.1108/17506141111118471
Tan (2020)	3	20	0.45	214.25	10.1016/j.jcorpfin.2020.101661
Dai (2015)	3	20	0.30	0.00	10.1080/14479338.2015.1011053
Li (2020)	3	18	0.41	122.26	10.1016/j.jcorpfin.2020.101668
Zhang (2020C)	3	15	0.37	47.08	10.1080/1540496x.2018.1542594
Kong (2020)	3	12	0.42	184.98	10.1016/j.jcorpfin.2020.101725
Wen (2018)	3	12	0.42	31.15	10.1080/1351847x.2017.1347573
Xu (2019)	3	11	0.34	50.19	10.1108/cfri-08-2017-0190
Zhang (2020B)	3	10	0.43	79.50	10.1016/j.chieco.2020.101450
Feng (2019)	3	10	0.39	37.25	10.1016/j.strueco.2019.06.012
Cao (2020)	3	9	0.35	0.43	10.1016/j.ememar.2020.100699
Wu (2018)	3	9	0.34	1.03	10.1080/1540496x.2018.1491400
Wu (2019)	3	8	0.32	2.33	10.1080/13504851.2018.1540839
Jiang (2020B)	3	7	0.48	549.09	10.1016/j.chieco.2020.101500
Quan (2021)	3	6	0.27	0.00	10.1108/jkm-12-2019-0684
Ul Ain	3	5	0.44	102.41	10.1108/ejim-10-2020-0439
Zhang (2020A)	3	5	0.37	106.02	10.1016/j.chieco.2020.101532
Wehrheim (2020)	3	4	0.43	41.34	10.1016/j.jcorpfin.2020.101626
Fu (2019)	3	4	0.39	6.16	10.1016/j.najef.2019.101037
Liu (2020B)	3	4	0.27	0.00	10.1080/15140326.2020.1806001
Wang (2021E)	3	3	0.39	23.99	10.1080/1540496x.2019.1613223
Fang (2020)	3	3	0.42	185.69	10.1016/j.jdeveco.2020.102561
Xia (2021)	3	2	0.36	91.44	10.1108/cms-04-2020-0126
Yu (2022)	3	2	0.34	2.86	10.1080/19761597.2020.1835501
Xu (2021B)	3	2	0.33	0.00	10.1111/acfi.12717
Bai (2019)	4	81	0.34	21.95	10.1016/j.jclepro.2019.06.107
Yang (2019)	4	73	0.35	19.29	10.1007/s10551-018-3830-5
Ouyang (2020)	4	72	0.27	105.00	10.1016/j.enpol.2020.111310
Hu (2020)	4	40	0.37	305.30	10.1016/j.techfore.2020.120122
Liu (2019)	4	30	0.32	72.23	10.1016/j.econmod.2018.11.027
Liu (2020A)	4	28	0.43	383.76	10.1016/j.jclepro.2019.118786
Wang (2018)	4	27	0.37	28.44	10.1016/j.enpol.2018.07.050
Hu (2021A)	4	19	0.28	15.78	10.1016/j.eneco.2021.105134
Wang (2019A)	4	16	0.34	43.84	10.1016/j.jenvman.2019.109586
Liu (2021B)	4	15	0.34	67.77	10.1016/j.jclepro.2021.126698
Jiang (2020A)	4	13	0.41	58.92	10.1007/s10551-019-04161-4
Zhang (2020D)	4	10	0.22	0.00	10.1016/j.techfore.2020.119953
Roud (2018)	4	7	0.35	20.02	10.1111/jiec.12643
Hu (2021B)	4	6	0.31	1.47	10.1016/j.jenvman.2020.111542
Sun (2020B)	4	5	0.31	42.59	10.1080/19761597.2020.1719018
Xin (2016)	4	3	0.24	0.00	10.1080/19761597.2016.1256705
Wang (2021A)	4	2	0.40	120.61	10.1016/j.jclepro.2021.128029

Appendix A2 Top 10 Most-Cited Articles on State Ownership and Innovation across Two Time Periods

Period	#	Authors	Year	Title	Journal	Journal Ranking	Cit.
2000-2013	1	Tan	2001	Innovation And Risk-Taking In A Transitional Economy: A Comparative Study Of Chinese Managers And Entrepreneurs	Journal of Business Venturing	4	164
	2	Lin et al.	2010	Property Rights Protection And Corporate R&D: Evidence From China	Journal of Development Economics	3	125
	3	White	2000	Competition, Capabilities, And The Make, Buy, Or Ally Decisions Of Chinese State-Owned Firms	Academy of Management Journal	4*	98
	4	Jefferson & Su	2006	Privatization And Restructuring In China: Evidence From Shareholding Ownership, 1995-2001	Journal of Comparative Economics	3	96
	5	Li	2011	Sources Of External Technology, Absorptive Capacity, And Innovation Capability In Chinese State-Owned High-Tech Enterprises	World Development	3	93
	6	Girma et al.	2009	What Determines Innovation Activity In Chinese State-Owned Enterprises? The Role Of Foreign Direct Investment	World Development	3	89
	7	Hu & Jefferson	2004	Returns To Research And Development In Chinese Industry: Evidence From State-Owned Enterprises In Beijing	China Economic Review	2	66
	8	Sun	2000	Spatial Distribution Of Patents In China	Regional Studies	4	60
	9	Tan	2005	Venturing In Turbulent Water: A Historical Perspective Of Economic Reform And Entrepreneurial Transformation	Journal of Business Venturing	4	48
	10	Xu & Zhang	2008	The Impact Of State Shares On Corporate Innovation Strategy And Performance In China	Asia Pacific Journal of Management	3	46
2014-2022	1	Zhou et al.	2017	State Ownership And Firm Innovation In China: An Integrated View Of Institutional And Efficiency Logics	Administrative Science Quarterly	4*	277
	2	Liu et al.	2017	Human Resource Systems, Employee Creativity, And Firm Innovation: The Moderating Role Of Firm Ownership	Academy of Management Journal	4*	148
	3	Wu et al.	2016	Internationalization And Innovation Performance Of Emerging Market Enterprises: The Role Of Host-Country Institutional Development	Journal of World Business	4	114
	4	Fang et al.	2017	Intellectual Property Rights Protection, Ownership, And Innovation: Evidence From China	Review of Financial Studies	4	98
	5	Wei et al.	2017	From Made In China To Innovated In China: Necessity, Prospect, And Challenges	Journal of Economic Perspectives	4	94
	6	Guariglia & Liu	2014	To What Extent Do Financing Constraints Affect Chinese Firms' Innovation Activities?	International Review of Financial Analysis	3	82
	7	Bai et al.	2019	The Impacts Of Government R&D Subsidies On Green Innovation: Evidence From Chinese Energy-Intensive Firms	Journal of Cleaner Production	2	77
	8	Jia et al.	2019	Public Governance, Corporate Governance, And Firm Innovation: An Examination Of State-Owned Enterprises	Academy of Management Journal	4*	75
	9	Rong et al.	2017	The Effect Of Institutional Ownership On Firm Innovation: Evidence From Chinese Listed Firms	Research Policy	4*	69
	10	Yang et al.	2019	Environmental Strategy, Institutional Force, And Innovation Capability: A Managerial Cognition Perspective	Journal of Business Ethics	3	65

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