

Mixed ownership reform and non-state-owned enterprise innovation: Evidence from China

Mixed-ownership reform and non-SOE innovation

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Abstract

Purpose – This study examines the impact of China's mixed-ownership reform on the innovation of non-state-owned acquirers, with a particular focus on the impact on firms with high financing constraints, low-quality accounting information or less tangible assets.

Design/methodology/approach – We use a proprietary dataset of firms listed on the Shanghai and Shenzhen Stock Exchanges to investigate the impact of mixed ownership reform on non-state-owned enterprise (non-SOE) innovation. We employ regression analysis to examine the association between mixed ownership reform and firm innovation.

Findings – The study finds that non-state-owned firms can improve innovation by acquiring equity in state-owned enterprises (SOEs) under the reform. Eased financing constraints, lowered financing costs, better access to tax incentives or government subsidies, lowered agency costs, better accounting information quality and more credit loans are underlying the impact. Additionally, cross-ownership connections amongst non-SOE executives and government intervention strengthen the impact, whilst regional marketisation weakens it.

Originality/value – This study adds to the literature on the association between mixed ownership reform and firm innovation by focussing on the conditions under which this impact is stronger. It also sheds light on the policy implications for SOE reforms in emerging economies.

Keywords Non-state-owned enterprises, Innovation, Mixed-ownership reform, State-owned enterprises, China

Paper type Research paper

1. Introduction

Non-state-owned enterprises (non-SOEs), or privately owned firms, have played a crucial role in China's remarkable economic growth in recent decades, rapidly expanding and making significant contributions. According to the National Bureau of Statistics, in 2020, non-SOEs accounted for over 50% of tax revenue, 60% of GDP, 70% of innovations, and 80% of employment in the country's largest emerging economy. However, non-SOEs have faced less favourable treatment than state-owned enterprises (SOEs) by the government, credit discrimination by banks, and limited access to financial resources through the stock and bond markets. These disadvantages have significantly disadvantaged non-SOEs in the marketplace (Fu, Lee, Xu, & Zurbrugg, 2015; He, Xu, & McIver, 2019; Wu & Xu, 2020; Pan, Xu, Li, Ling, & Lu, 2022; Xu, Liu, Li, & Ma, 2022; Xu, Li, Ma, & Liu, 2023; Ma, Xu, Anwar, & Lu, 2023), which may hinder China's long-term sustainable economic growth (Allen, Qian, & Qian, 2005; Cull & Xu, 2005; Berger, Hasan, & Zhou, 2009).

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The mixed ownership reform (the Reform [1]) presents an innovative opportunity to integrate the advantages of SOEs and non-SOEs, potentially enhancing firm efficiency and resource allocation by allowing foreign or non-SOEs to acquire ownership of SOEs and vice versa (Harrison, Meyer, Wang, Zhao, & Zhao, 2019; Li, Xu, McIver, Liu, & Pan, 2022). SOEs are often less efficient than non-SOEs due to their role as government policy conduits with political targets (Xu & Lin, 2007; Estrin, 2008; Xu, Lee, & Fu, 2015; Xu, McIver, Shan, & Wang, 2016; Xu, Ma *et al.*, 2023; Nabin, Sgro, Nguyen, & Chao, 2016; Cui, Xu, Zhang, & Zhang, 2019; Wu, Xu, & Jiang, 2023). The dominance of either state or non-state ownership, featured by high transaction costs and imperfect contracts, may lead to less efficient firm governance and, subsequently, poorer performance outcomes (Li, Xu, McIver, Wu, & Pan, 2020; Li, Pan, Xu, Liu, & Qin, 2020, 2022; Zhang, Yu, & Chen, 2020). Under the Reform, non-SOEs may acquire improved economic and political status by becoming joint owners of current SOEs through equity investment. This enhanced status may reduce ownership-based discrimination (Brandt & Li, 2003), easing the financing constraints of acquiring non-SOEs and lowering their cost of debt. Furthermore, improved political status may reduce non-SOE market disadvantage, granting them access to markets traditionally exclusive to SOEs, preferential access to government resources, and the ability to form legitimate contractual relationships with the government.

However, there is a significant difference in the willingness and capacity to engage with innovation issues between SOEs and non-SOEs (Lazzarini & Musacchio, 2018), with a substantial innovation gap between them in China's case (Zhang *et al.*, 2020). Corporate innovation often requires long-term investments and significant risk-taking activities, which can impose further information asymmetry on non-SOEs in the financial market (Hall, 2002; Wu & Xu, 2022; Li, Guo, Xu, & Meng, 2024). Since non-SOEs may face traditional disadvantages in accessing financial resources, they are often financially constrained in pursuing innovation. Existing literature has examined the innovation of SOEs (Zhao & Lan, 2015; Zhou, Gao, & Zhao, 2017; Cao, Cumming, & Zhou, 2020), the impact of reform on the innovation of SOEs (He, 2016; Tan, Tian, Zhang, & Zhao, 2020; Zhang, Zhang, & Zhao, 2003, 2020; Zhan & Zhu, 2020), and non-SOEs' innovation from the perspectives of executive characteristics (Sunder, Sunder, & Zhang, 2017), governance (Mao & Zhang, 2018), financial market development (Hsu, Tian, & Xu, 2014), and legal environment (Fang, Lerner, & Wu, 2017), but has largely ignored the Reform and its potential impacts on innovation.

The significant gap between the innovation of non-SOEs and SOEs in China suggests that ownership changes resulting from the Reform may negatively or positively impact economy-wide innovation [2]. This raises important questions regarding the impact on resourcing and innovation for non-SOEs that acquire equity stakes in SOEs under the Reform. Specifically, do non-state-owned acquirer firms experience reduced financing costs and other resource constraints because of the Reform, such as tax incentives and government subsidies? Do these firms improve their political status? What is the Reform's impact on the active innovation of non-state-owned acquirer firms?

This study aims to investigate the relationship between non-SOEs participating in the Reform and their level of innovation. Using a proprietary dataset of listed firms on the Shanghai and Shenzhen Stock Exchanges, we contribute to the scarce literature on changes in non-SOE innovation in the context of property rights reforms. The Reform provides us with a useful scenario to study this relationship. Our findings show that non-SOEs that acquire equity in state-controlled or state-owned enterprises experience an improvement in their economic and political status and innovation levels. Further tests suggest that the Reform promotes non-SOE innovation through eased financing constraints, lower financing costs, and better access to tax incentives or government subsidies. The Reform may also help reduce agency costs, improve accounting information quality, and enhance debt guarantee, which underlie eased financing constraints. Better innovation may also help improve firm

value. Additionally, cross-ownership connections (COCs) [3] of non-SOE executives and government intervention positively strengthen the impact, whilst the level of marketisation weakens it. These findings are robust after controlling endogeneity issues.

This study contributes to the literature in the following aspects. First, this study examines the consequences of the Reform from a non-SOE innovation perspective, particularly in the context of non-state-owned acquirers. This study provides theoretical and empirical evidence from the world's largest emerging market. The existing literature on the Reform has mainly focused on discussing the rationality, mechanisms for achieving, and the influence of mixed ownership, as pointed out by Schmidt (1996). Additionally, some studies have raised concerns about the economic consequences of non-SOE participation in the Reform. However, little attention has been paid to the non-SOEs under the Reform (Li *et al.*, 2022). This study can contribute new insights into the Reform on the innovation of non-SOEs. Unlike previous literature on the political connections of non-SOEs and bank-firm links (He *et al.*, 2019; Pan & Tian, 2020), we find that participation in the Reform can also be an effective means for non-SOEs to gain improved access to government resources and bank loans. The Reform alleviates non-SOE financing constraints and improves their accounting information quality, increasing debt guarantee capacity and access to government resources. COCs, regional marketisation, and government intervention moderate the Reform's impact, improving innovation and firm value. Second, the study contributes to the literature on dynamic innovation amongst non-SOEs. Whilst previous research has mostly examined the privatisation of SOEs and their financial performance (Megginson & Netter, 2001; Guan, Gao, Tan, Sun, & Fan, 2021), policy burden (Liao, Chen, Jing, & Sun, 2009), innovation capabilities (He, 2016; Tan *et al.*, 2020; Zhang *et al.*, 2003, 2020; Zhan & Zhu, 2020), and cost of capital, little attention has been given to the innovation of non-SOEs. By examining the potential benefits of the Reform for non-SOEs, such as better access to resources, this study enriches the literature on dynamic innovation in the emerging market context. Third, this study contributes to the growing body of literature on innovation amongst firms in emerging markets. The existence of different property rights may lead to variations in firm innovation (Lazzarini & Musacchio, 2018). Literature on this topic mainly focuses on innovation by SOEs. Current literature suggests that SOEs may demonstrate lower efficiencies or capabilities of innovation than non-SOEs; therefore, privatisation may lead to better innovation (He, 2016; Tan *et al.*, 2020). However, some other studies suggest otherwise (Zhao & Lan, 2015; Xu *et al.*, 2016) and that minority SOEs may be more efficient and have optimal structures for innovation (Zhou *et al.*, 2017; Cao *et al.*, 2020). Interestingly, there seems to be insufficient attention to innovation by non-SOEs. The Reform in China provides a unique opportunity to examine the dynamic nature of non-SOE innovation and how it changes over time, given the country's dual-track economy.

The remaining parts of the paper are organised in the following manner. Section 2 provides a literature review and outlines the hypotheses of the study. Section 3 presents a detailed explanation of the data and research methodology used. Section 4 analyses the results obtained from the study. Section 5 investigates the underlying mechanisms that drive the results. Section 6 expands the analysis by considering moderation factors and exploring the economic implications of the findings. Finally, Section 7 concludes the paper.

2. Literature review and hypotheses

2.1 Innovation and financing constraints

Innovation is an important driving force for the sustainable growth and competitive advantages of firms, impacting their economy-wide performance (Porter, 1992). However, innovation can be highly risky and particularly affected by financial constraints (Hall, 2002; Li *et al.*, 2024). Most firms cannot sustain innovation projects with internal funds, so they

must resort to external sources (Brown, Fazzari, & Petersen, 2009; Brown, Martinsson, & Petersen, 2012; Brown & Petersen, 2011). Besides the stock market, bank loans can be another important funding source to support their innovation (Benfratello, Schiantarelli, & Sembenelli, 2008; Amore, Schneider, & Zaldokas, 2013). However, due to the complexity, long term, and high uncertainty, information asymmetry and potential moral hazard make it difficult for outsiders to evaluate innovation projects. Moreover, firms are often reluctant to reveal detailed information on their innovations and pay higher costs to finance them externally (Hottenrott & Peters, 2012).

Non-SOEs in China often face significant financing limitations, leading to a competitive disadvantage in the market compared with SOEs (Xu *et al.*, 2016). This discrepancy in political and economic status has persisted for a long time, with non-SOEs having weaker property right relationships with the government than SOEs. As an embodiment of government ideology, SOEs control most of the country's resources. SOE executives are often considered government officials, and party committees supervise them at all levels of the organisation. Due to their political connections, SOEs are more likely to access government subsidies, major national projects, and other favourable conditions such as land acquisition, giving them an advantage over non-SOEs. The enduring effects of these disparities have shaped the business environment in China. The absence of political status makes it challenging for non-SOEs to compete with SOEs in government subsidy applications, bidding on major projects, and tax optimisation. Additionally, non-SOEs have difficulty accessing financing through bank credit markets, initial public offerings, and bond markets compared with SOEs (Brandt & Li, 2003). The capture of financial resources by SOEs results in a crowding-out effect, leading to discriminatory treatment of competing non-SOEs in China's capital markets (Cull & Xu, 2003, 2005; He *et al.*, 2019). State-controlled banks prefer lending to SOEs, creating an uneven playing field in the world's largest bank-based market (Xu & Lin, 2007; Fu *et al.*, 2015; Wu & Xu, 2018). SOEs have more resources for innovation (Choi, Lee, & Williams, 2011; Zhang *et al.*, 2020) and importing patents (Liu, Lu, Lu, & Luong, 2021), whilst non-SOEs often face financial constraints in their survival or development.

2.2 The Reform and alleviation of financing constraints

The Reform may help alleviate financing constraints for non-SOEs in the following aspects. First, the Reform may improve their governance, enhance accounting information quality, and lower information asymmetry. For a long time, non-SOEs in China have been criticised for their features of family control, poor governance, low-quality accounting information, and abusive tunnelling issues (Friedman, Johnson, & Mitton, 2003). The bootstrap effect suggests that an acquirer with weak governance can voluntarily adjust to the target's better governance (Martynova & Renneboog, 2008). As a possible result, non-state-owned acquirer firms in China can bootstrap their governance to higher standards and bring positive valuations by taking over state ownership. The government, analysts, and public media may also impose more public scrutiny on the non-state-owned acquirer firms under the Reform and subsequently force non-SOEs to improve their accounting information quality (Lang, Miller, & Miller, 2004; Yu, 2008; Dyck, Volchkova, & Zingales, 2013). In addition, non-SOEs, after the acquisition, may also be forced to improve the quality of accounting information. Government ownership may effectively curb earnings management by private shareholders and lower the information asymmetry to alleviate financing constraints.

Second, acquiring state ownership may help reduce the risk of non-state-owned acquirer firms, improve creditor trust, lower financing costs, and alleviate financing constraints for innovation. Unlike SOEs, non-SOEs must face more competition in the market, higher operation risks, and ownership discrimination. Creditors allocate higher risk weights and impose strict conditions on non-state-owned borrowers (Almeida & Campello, 2007). Binding

with SOEs may allow them to access government resources traditionally exclusive to SOEs. Improved legitimacy and reputation can give non-SOEs better bargaining power with their creditors (Li *et al.*, 2022). Actively participating in the Reform can also signal a guarantee to the creditors that the non-state-owned acquirer firms are higher quality borrowers and less exposed to insolvency risks. Subsequently, the Reform may reduce biases against non-SOEs accessing external financial resources and reduce their debt financing costs.

Furthermore, participation in the Reform may enhance the trust of non-SOEs by investors and creditors. In an economy dominated by state ownership, non-SOEs have been heavily criticised for lacking corporate social responsibility and having higher default risk (Xu *et al.*, 2016; Dong, Xu, & McIver, 2020, 2022; Pan *et al.*, 2022). In comparison, besides economic benefits, SOEs often attend to the benefits of other stakeholders with a stronger sense of corporate social responsibility. As a possible result, non-SOEs, by participating in the Reform, may better scrutinise their executives, improve their legitimacy, better perform their social responsibility, and lower their risk towards creditors. Given that the government is also selective of non-state-owned acquirers in the Reform, non-SOEs, by participating in the Reform, may transmit such signals to the market that they are better firms than other non-state-owned ones.

Third, the Reform may lead non-SOEs to gain better access to government resources and alleviate their financing constraints. Social capital and networks are important conditions for business growth in China's relationship-based society (Boxiot & Child, 1999; Fan, 2021). Strong connections allow better access to scarce resources and trust, which are detrimental towards innovation breakthroughs (Badi, Wang, & Pryke, 2017). Non-SOEs are often constrained by family-controlled resources and networks. Current studies suggest that family-controlled firms often cannot allocate sufficient resources for innovation activities (Gomez-Mejia, Cruz, Berrone, & De Castro, 2011), which may negatively affect firm growth and survival (Naldi, Nordqvist, Sjöberg, & Wiklund, 2007). Both local and central governments in China heavily invest through tax incentives, government subsidies, discounted loans, innovation funds, etc., to promote innovation (Feng, Johansson, & Zhang, 2015). However, SOEs are often favoured in distributing government-controlled resources (Xu *et al.*, 2015; He *et al.*, 2019; Wu, Zhang, & Xu, 2023). However, non-SOEs may establish long-term and collaborative relationships with the government by participating in the Reform and gain better access to government-controlled resources (Li *et al.*, 2022). Furthermore, the Reform allows non-SOEs to share economic returns with the government, which, in turn, may attract more government support. Given that innovation contributes to long-term the competitive advantage and economic growth, non-SOEs may be keen to invest more resources in innovation, which conforms with government targets. In comparison, non-SOEs participating in the Reform may be advantaged in accessing government-controlled resources compared with non-SOEs not participating in the Reform. Developing collaborative ties with the government and SOEs can be an important means for non-SOEs in a highly competitive market (Li, Xu *et al.*, 2020). The Reform may bring close ties with the government and enable non-SOEs to gain better access to bank loans at lower costs (Sapienza, 2004; Din, 2005). In addition, non-SOEs may also enjoy government subsidies and tax incentives (Faccio, Masulis, & McConnell, 2006; He *et al.*, 2019). Both government subsidies and tax relief may lead to increased cash flows and enhanced firm innovation (Bloom, Griffith, & Van Reenen, 2002; Lach, 2002; He *et al.*, 2019). Participation in the Reform may help non-SOEs establish new ties with the government and get support traditionally unavailable towards non-SOEs, which is meaningful towards alleviating financing constraints.

Based on the above theoretical discussion, we develop our first hypothesis:

- H1.* Non-state-owned firms that acquire state ownership to create mixed ownership enterprises under the Reform significantly enhance their innovation capability.

2.3 *The Reform and political connections*

Non-SOEs often have strong incentives to develop and maintain political connections as part of their social capital. Evidence from both developed and developing markets suggests political connections can significantly improve their external financing, including bank loans and equity, and effectively alleviate financial constraints (Johnson & Mitton, 2003; Khwaja & Mian, 2005; Claessens, Feijen, & Laeven, 2008; Boubakri, Guedhami, Mishra, & Saffar, 2012). Political connections can also play significant roles in the external financing activities of non-SOEs (Chen, Li, Sun, & Sun, 2011; Chen, Sun, Tang, & Wu, 2011; Guo, Shi, Tian, & Duan, 2021). The Reform allows non-SOEs to actively interact with the government and develop new business ties, which may help gain government support and improve innovation capabilities.

However, business ties with the government and SOEs developed by non-SOEs under the Reform may, at least to a certain extent, substitute political connections required by non-SOEs to alleviate their financial constraints for innovation. In other words, the Reform may moderate the impact of the political connections of non-state-owned acquirer firms on innovation. In China's context of state ownership of major banks, banks are required to follow government policies in their lending practice (Allen *et al.*, 2005; Xu & Lin, 2007; Fu *et al.*, 2015; Xu *et al.*, 2015; Wang, Luo, Tian, & Yan, 2020), and may subsequently provide more financial resources to non-SOEs acquiring state ownership under the Reform.

In comparison, non-SOEs, with political connections before the Reform, may have fewer financing constraints for innovation purposes. When these firms participate in the Reform, they may be less dependent on such connections to alleviate financing constraints. In other words, non-SOEs, without political connections but participating in the Reform, may experience a noticeable alleviation of financing constraints for innovation capabilities.

Based on the above theoretical discussion, we develop our second hypothesis:

H2a. Non-state-owned firms that acquire state ownership under the Reform but without political connections significantly improve their innovation capability better than those with political connections.

H2b. Non-state-owned firms that acquire state ownership under the Reform but with political connections significantly improve their innovation capability better than those with political connections.

2.4 *The Reform and bank connections*

Non-SOE ties with banks can also be important for accessing external financial resources. They may hire executives with banking backgrounds to establish these ties and gain more financial resources (Kobayashi & Takaguchi, 2018; Pan & Tian, 2020). In the largest bank-based economy, bank connections can be important social capital, besides political connections, for non-SOEs. Evidence also suggests that, like political connections, bank connections can lower information asymmetry, improve their access to bank loans, improve loan conditions, and alleviate financing constraints (Behr, Entzian, & Stettler, 2011; Kysucky & Norden, 2015; Bonini, Dell'Acqua, Fungo, & Kysucky, 2016; Wu & Xu, 2020). As a possible result, non-SOEs with bank connections may, through the Reform, further expand their connections and gain access to government resources to enhance their innovation capabilities.

In the meantime, like our discussion in sections 2.2 and 2.3, non-SOEs with bank connections before participating in the Reform may not have financing constraints for corporate innovation. Given their bank connections, they may not need additional resources to alleviate their financing constraints for innovation. In other words, through acquiring state ownership, non-SOEs without bank connections may develop business ties with the government and SOEs and access more external financial resources for innovation.

Based on the above theoretical discussion, we develop our third hypothesis:

- H3a.* Non-state-owned firms that acquire state ownership under the Reform but also with bank connections significantly improve their innovation capability better than those without bank connections.
- H3b.* Non-state-owned firms that acquire state ownership under the Reform but without bank connections significantly improve their innovation capability better than those with bank connections.

Mixed-ownership reform and non-SOE innovation

3. Data and methodology

3.1 Data

We use all listed A-share non-SOEs on the Shanghai and Shenzhen stock exchanges between 2010 and 2017 as our initial sample [4]. We consider the acquisition of the target company as a merger and acquisition (M&A) event and specifically select M&A activities by non-state-owned listed companies. We determine the legal nature of each firm's ultimate controllers to identify them as non-SOEs [5]. However, we exclude M&A activities by financial institutions because of their unique business model, competitive situation, and financial structure, which significantly differ from non-financial enterprises. We exclude M&A activities for asset divestiture, debt restructuring, asset replacement, or share repurchase purposes. We only focus on equity acquisitions and exclude asset acquisitions such as land and other asset acquisitions. We believe that asset replacement and divestiture, debt restructuring, and acquisition of land use rights and other asset acquisitions are not true mixed-ownership reforms defined by the M&A model. The purpose of mixed ownership M&As is to achieve the complete integration of state-owned and non-state-owned capital within the same operating entity, thereby reaping the dual advantages of the two. To avoid counting multiple instances of a non-SOE acquiring the equity of the same target firm, we consider them as a single M&A event. To ensure non-SOEs participating in the Reform for the first time, we exclude non-SOEs with SOE shareholders or those with any top 10 shareholders of ultimate state control before the M&As [6]. After excluding M&As with missing data, we were left with 1,323 valid takeovers in our sample. We manually identified 280 private acquisitions of SOE equity in the sample period by reviewing firm merger disclosures and conducting Baidu, Google, and Tianyancha.com searches on the ultimate ownership of target firms [7]. Table 1 reports the distribution of non-SOEs joining the Reform.

We further applied Propensity Score Matching (PSM) to identify non-SOEs that only acquired ownership of other non-SOEs in the sample period. Through all the control variables (as defined in 3.2 below), we scored the nearest neighbour of non-SOEs not participating in the Reform and got 374 observations. ATT test results confirm that our PSM is valid, with a *t*-test value of 5.54 and far above 1.69. Table 2 reports our balance test results, which suggest satisfactory data balance between the groups.

We obtained information on M&A events, financial indicators, and firm governance from the CSMAR database, a widely used financial and economic database for Chinese listed companies. We also winsorize continuous variables at the one per cent level to remove extreme values.

	2010	2011	2012	2013	2014	2015	2016	2017
Non-SOEs acquire equity in listed SOEs	19	53	42	32	37	48	15	34

Note(s): Table by authors

Table 1.
Distribution of non-SOE participation in the reform

Variable	Unmatched Matched	Mean		% Reduct.		<i>t</i> -test		V(T)/V(C)
		Treated	Control	% bias	bias	<i>t</i>	<i>p</i> > <i>t</i>	
<i>Lnage</i>	U	2.600	2.528	17.10	2.560	0.0100	1.080	1.08
	M	2.600	2.584	3.700	78.30	0.440	0.661	1.090
<i>Lnsiz</i>	U	22.02	21.57	47.20	7.350	0	1.37*	1.37*
	M	22.02	22.03	-0.900	98	-0.100	0.919	0.970
<i>Growth</i>	U	0.338	0.299	6	0.990	0.323	2.01*	2.01*
	M	0.338	0.392	-8.100	-35.60	-0.880	0.380	1.28*
<i>Power</i>	U	1.714	1.714	0	-0.0100	0.995	1.210	1.21
	M	1.714	1.713	0	92.60	0	1	1.180
<i>RoA</i>	U	0.0512	0.0509	0.700	0.100	0.920	1.240	1.24
	M	0.0512	0.0503	1.900	-187.6	0.220	0.825	1.190
<i>Lev</i>	U	0.399	0.345	29.80	4.480	0	1.090	1.09
	M	0.399	0.393	3.300	89	0.380	0.707	0.970
<i>Indro</i>	U	0.373	0.371	4.500	0.660	0.512	0.890	0.89
	M	0.373	0.375	-3.500	22.90	-0.400	0.693	0.78*
<i>Lnboard</i>	U	2.219	2.210	5.300	0.780	0.433	1.010	1.01
	M	2.219	2.228	-5.800	-9.900	-0.690	0.490	1.040
<i>Ratio</i>	U	5.618	5.690	-2.100	-0.310	0.758	0.960	0.96
	M	5.618	5.807	-5.500	-161.4	-0.650	0.518	0.960

Table 2.
Balance test results

Note(s): Table by authors

3.2 Variables

We use the change in patent applications ($\Delta Lnpatent$), the logarithm of patent applications in the second year following the acquisition minus the logarithm of patent applications [8] in the year before the acquisition, to measure changes in firm innovation. Considering that traditional R&D investment can only measure firm innovation inputs, we use patent applications to measure R&D output. $\Delta Lnpatent$ can demonstrate firm innovation differences before and after acquiring state ownership under the Reform.

The Reform (*Reform*) is a dummy variable on whether the non-SOE has acquired SOE shares under the Reform. If yes, it equals 1; otherwise, it equals 0 (Li, Xu et al., 2020, 2022).

Political connections (*POL*) measure the social backgrounds of the CEO and chairman of a non-SOE. If the CEO or chairperson is any of the following: former Communist Party or government official, former military officer, current or former People's Congress (PC) member, current or former Chinese People's Political Consultative Conference (CPPCC) member, *POL* equals 1, otherwise 0 (Fan, Wong, & Zhang, 2007).

Bank connections (*BC*) measure non-SOE's ties with banks. If the firm holds a bank's shares, or the bank holds the firm's shares, or any firm executive has a banking background, or a bank executive is also a firm executive, *BC* equals 1; otherwise, 0.

We also adopt a list of control variables, which include firm age (*Lnage*), firm size (*Lnsiz*), growth rate (*Growth*), market power (*Power*), profitability (*ROA*), leverage (*Lev*), ratio of independent directors (*Indro*), board size (*Lnboard*), M&A ratio (*Ratio*), year (*Year*), and industry (*Ind*). See Table 3 for their detailed definitions.

3.3 Methodology

We develop the following Equ.1 as our primary model to examine the impact of the Reform on innovation amongst non-SOE acquirers.

$$\Delta Lnpatent = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \epsilon \quad (\text{Equ. 1})$$

Variables	Definition and measurement
$\Delta Lnpatent$	The logarithm of patent applications in the second year following the acquisition minus the logarithm of patent applications in the year prior to the acquisition In China, patent applications are disaggregated into invention, utility, and design types. Respectively, we use the logarithm of each type of patent applications in the second year following the acquisition minus the logarithm of this type of patent applications, i.e. $\Delta Lnpatent1$, $\Delta Lnpatent2$, and $\Delta Lnpatent3$ to represent changes in these three types of patent applications
<i>Reform</i>	Dummy variable, equals to 1 if a private firm acquires state ownership in the year, otherwise 0
<i>POL</i>	Dummy variable, equals to 1 if the CEO or chairman has served as a Communist Party, government, or military officer, has been a People's Congress, or the Chinese People's Political Consultative Conference member, otherwise it is 0
<i>BC</i>	Dummy variable, equals to 1 the firm holds a bank's shares, or the bank holds the firm's shares, any firm executive has a banking background, or a bank executive is also firm executive, otherwise 0
<i>lnage</i>	Natural logarithm of the company's listing years
<i>Lnsize</i>	Natural logarithm of the company's total assets
<i>Growth</i>	(Operating income of the current period minus operating income of the previous period) divided by operating income of the previous period
<i>Power</i>	Operating income divided by operating cost
<i>RoA</i>	Net profit divided by net assets
<i>Lev</i>	Total liabilities divided by total assets
<i>Indro</i>	The ratio of independent directors to the board of directors
<i>Lnboard</i>	The total number of board members takes the natural logarithm
<i>Ratio</i>	Percentage of acquired shares of SOEs

Note(s): Table by authors

Table 3.
Variables and definitions

where α_1 shows the Reform's impact on innovation. Given *Reform* only has values of 1 or 0, a significant and positive value of α_1 would suggest that the Reform improves innovation.

4. Results analysis

4.1 Summary statistics

Table 4 reports the summary statistics of variables. *Reform* has a mean value of 0.21, suggesting that a small portion of listed non-SOEs acquired state ownership under the Reform. In other words, most non-SOEs seem reluctant or cautious to acquire state ownership from listed SOEs. $\Delta Lnpatent$ has a positive mean value during the sample period, suggesting that non-SOEs improve their innovation. *POL* and *BC* have respective mean values of 0.370 and 0.390, suggesting that many non-SOEs have political and bank connections. Interestingly, *Ratio* has a mean value of 0.567, suggesting that non-state-owned acquirer firms tend to control most shares of target firms once they decide to buy state ownership under the Reform.

We further divide non-SOEs into groups acquiring state ownership and those acquiring ownership of other non-SOEs, i.e. *Reform* equals 1 and 0. **Table 5** reports that non-SOEs acquiring state ownership have much higher $\Delta Lnpatent$ values than other non-SOE targets.

4.2 Primary test results

Table 6 reports our primary test results. Columns (1) and (2) indicate that the Reform is significantly and positively related to the innovation of non-SOEs. Non-SOEs participating in the Reform experience sharper increases in patent applications than those not participating, supporting our **H1**. The coefficient of 0.5681 shows that the value added of the number of patent applications of non-SOEs in the second year after participating in the Reform and the

Table 4.
Summary statistics

Variable	N	Mean	SD	p50	Min	Max
<i>ΔLnpatent</i>	654	0.560	0.920	0.450	−1.980	3.480
<i>Reform</i>	654	0.430	0.500	0	0	1
<i>POL</i>	654	0.310	0.460	0	0	1
<i>BC</i>	654	0.330	0.470	0	0	1
<i>Lnage</i>	654	2.570	0.420	2.640	1.390	3.330
<i>Lnsize</i>	654	21.93	1	21.81	19.82	25.01
<i>Growth</i>	654	0.350	0.730	0.200	−0.500	4.970
<i>Power</i>	654	1.710	0.920	1.430	0.990	6.180
<i>Roa</i>	654	0.050	0.040	0.050	−0.090	0.200
<i>Lev</i>	654	0.380	0.190	0.380	0.050	0.880
<i>Indro</i>	654	0.370	0.050	0.330	0.300	0.570
<i>Lnboard</i>	654	2.220	0.160	2.300	1.790	2.560
<i>Ratio</i>	654	5.640	3.490	5.100	0	10

Note(s): Table by authors

Table 5.
Changes in non-SOE
innovation

		N	Mean test Mean	T-test	Median test Median	Z-test
<i>ΔLnpatent</i>	<i>Reform</i> = 1	280	0.8224	6.51***	0.69	6.187***
	<i>Reform</i> = 0	374	0.3626		0.26	

Note(s): *Reform* = 1 indicates that private acquirer firms purchase state ownership under the Reform. *Reform* = 0 indicates that private acquirer firms purchase privately owned equity during the sample period

Source(s): Table by authors

number of patent applications in the year before the Reform increased by 76.49% ((exp (0.5681)−1)*100%) compared with that of non-SOEs not participating in the Reform. Columns (3), (4), and (5) indicate disaggregated changes in three types of patent applications, suggesting that the Reform is significantly and positively related to invention and utility types of innovations but not related to the design type. Columns (6) and (7) report our test results on the Reform and the political connections of non-SOEs. These results suggest that the Reform may partially substitute political connections for non-SOEs to acquire necessary financial resources for innovation. Non-SOEs without political connections can be significantly and positively impacted by the Reform on their innovation.

In comparison, non-SOEs with political connections still show a positive but less significant impact of the Reform on their innovation. These results are supportive of our H2a. Columns (8) and (9) compare the impact of the Reform on non-SOEs with and without bank connections. The Reform is significant and positive towards both groups, with a greater impact on non-SOEs without bank connections. In other words, the Reform can substitute bank connections for non-SOEs to access financial resources for innovation, partially supporting our H3b. In short, the Reform can significantly improve the innovation of non-state-owned acquirer firms, with stronger impacts on non-SOEs without political or bank connections.

4.3 Robustness

To mitigate possible endogeneity issues, we adopted a list of robustness tests.

First, we use alternative innovation measurement. The Reform may help non-state-owned acquirer firms to alleviate financing constraints for innovation. Consequently, after acquiring

Variable	(1) Full sample $\Delta lnpatent$	(2) Full sample $\Delta lnpatent$	(3) Full sample $\Delta lnpatent1$	(4) Full sample $\Delta lnpatent2$	(5) Full sample $\Delta lnpatent3$	(6) Political connections $\Delta lnpatent$	(7) Without political connections $\Delta lnpatent$	(8) Bank-connections $\Delta lnpatent$	(9) Without bank connections $\Delta lnpatent$
<i>Reform</i>	0.5552*** (7.53)	0.5681*** (7.77)	0.2235** (2.40)	0.3352*** (3.23)	0.0843 (1.02)	0.4083** (2.41)	0.7124*** (8.69)	0.2656** (2.48)	0.7357*** (8.86)
<i>Lnage</i>		-0.0797 (-0.85)	-0.0770 (-0.65)	-0.1290 (-0.97)	0.0249 (0.24)	0.1103 (0.55)	-0.0722 (-0.68)	0.0695 (0.39)	-0.0931 (-0.86)
<i>Lnsiz</i>		-0.0443 (-0.96)	-0.1599*** (-2.72)	0.0051 (0.08)	0.0255 (0.49)	-0.2191** (-2.14)	-0.0118 (-0.24)	-0.2264** (-2.27)	-0.0087 (-0.17)
<i>Growth</i>		0.1010** (2.06)	0.1388** (2.23)	0.1710** (2.46)	0.0980* (1.78)	0.2125 (1.36)	0.0970** (1.98)	0.0798 (0.65)	0.0827 (1.60)
<i>Power</i>		-0.0434 (-1.11)	0.0044 (0.09)	-0.0311 (-0.56)	0.0503 (1.14)	0.0074 (0.09)	-0.0573 (-1.35)	0.0273 (0.34)	-0.0553 (-1.29)
<i>RoA</i>		2.0607** (2.23)	2.4338** (2.07)	3.1009** (2.37)	2.1013** (2.02)	1.3817 (0.64)	2.2325** (2.30)	1.8744 (0.91)	2.3329** (2.37)
<i>Lev</i>		-0.0267 (-0.10)	-0.3074 (-0.92)	-0.6016 (-1.62)	-0.4341 (-1.47)	0.3949 (0.71)	-0.0953 (-0.33)	0.5875 (1.11)	-0.0632 (-0.22)
<i>Indro</i>		1.4453** (2.05)	1.3369 (1.49)	1.2998 (1.30)	1.0628 (1.34)	1.6736 (1.21)	1.1575 (1.46)	1.9101 (1.41)	1.0648 (1.33)
<i>Lnboard</i>		0.1926 (0.88)	0.1852 (0.66)	0.0448 (0.14)	0.2398 (0.97)	-0.3725 (-0.84)	0.3643 (1.47)	-0.3449 (-0.82)	0.3879 (1.53)
<i>Ratio</i>		0.0114 (1.10)	0.0028 (0.21)	0.0250* (1.70)	0.0096 (0.82)	0.0416* (1.79)	-0.0061 (-0.53)	0.0510** (2.29)	-0.0091 (-0.78)
<i>Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ind</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.1131 (0.41)	0.1659 (0.15)	3.4762** (2.55)	0.3030 (0.20)	-1.8037 (-1.49)	5.4186** (2.32)	-1.1643 (-0.99)	5.1397** (2.27)	-1.2654 (-1.06)
<i>N</i>	654	654	654	654	654	204	450	214	440
<i>R²_Adj</i>	0.126	0.147	0.350	0.263	0.101	0.101	0.249	0.0744	0.257
<i>F</i>	2.960	2.979	7.177	5.095	2.282	2.457	3.610	2.336	3.661
Chow test						0.032		0.014	

Note(s): This table reports our measurement results through $\Delta lnpatent = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Variables are as defined in Table 2. ***, **, and *respectively indicate significance level at 1, 5, and 10%

Source(s): Table by authors

Table 6.
Primary test results

state ownership under the Reform, non-SOEs may increase their R&D investment. We define the change in R&D investment as $\Delta R\&D = (\text{R\&D investment two years after the acquisition}) - (\text{R\&D investment in the year before the acquisition})$. We replace $\Delta lnpatent$ with $\Delta R\&D$ and repeat our primary test. Panel A of Table 7 reports our alternative measurement results, which conform with our primary test results.

Second, we add control over the innovation capability of non-SOEs. Considering that those with better innovation capacity may be more active in acquiring state ownership under the Reform, rather than the Reform improving their innovation, we add a dummy variable *Ability* to control for their innovation capability, where a firm's R&D investment is above the median, *Ability* equals 1, otherwise, 0. Then, we re-do our tests. Panel B of Table 7 reports our results with an additional control, where our primary results remain robust.

Third, we add the financing constraint control variable, Kaplan-Zingales (KZ) index, to our tests. Given that firms with lower financing constraints may be more likely to participate in the Reform, we may need to exclude our sample selection bias in our primary tests. For such a purpose, we use the KZ index of the non-SOE firm in the year before participating in the Reform and re-do our tests.

To calculate the KZ index, we first take the median of five ratios: net operating cash flow/total assets of the previous period ($CF_{i,t}/A_{i,t-1}$), cash dividends/total assets of the previous

Variable	(1)	(2)	Panel A		(5)	(6)	(7)	Panel B		(10)
	Full sample ΔRD	Political connections ΔRD	Non-political connections ΔRD	Bank connections ΔRD	Non-bank connections ΔRD	Full sample $\Delta hp patent$	Political connections $\Delta hp patent$	Non-political connections $\Delta hp patent$	Bank connections $\Delta hp patent$	Non-bank connections $\Delta hp patent$
Reform	0.5886** (2.44)	0.4562 (1.53)	1.0046* (1.83)	0.4508 (1.48)	0.8716* (1.68)	0.5507*** (7.58)	0.4171** (2.48)	0.6992*** (8.51)	0.2135** (2.57)	0.7227*** (8.67)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-1.7159 (-0.50)	-2.9694 (-0.71)	-0.0490 (-0.01)	-2.9594 (-0.70)	-0.6907 (-0.09)	0.1766 (0.17)	5.3239** (2.30)	-1.1082 (-0.94)	5.1602** (2.31)	-1.2221 (-1.03)
N	580	394	186	386	194	654	204	450	214	440
R ² _Adj	0.0123	0.0128	0.0415	0.00964	0.0497	0.163	0.121	0.252	0.101	0.259
F	2.129	2.091	2.163	2.067	2.202	3.187	2.548	3.607	2.463	3.645
Chow test		0.062		0.056			0.027		0.016	

Note(s): Panel A reports our measurement results through $\Delta R\&D = \alpha_{-}(0) + \alpha_{-}(1)Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + e$. Panel B reports our measurement results through $\Delta Lnpatent = \alpha_0 + \alpha_1Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + e$ (Equ 0.1). Variables are as defined in Table 2. ***, **, and *respectively indicate significance level at 1, 5, and 10%

Table 7.
Robustness test results

Source(s): Table by authors

period ($Div_{i,t}/Ai_{t-1}$), cash holdings/total assets of the previous period ($Csh_{i,t}/Ai_{t-1}$), asset-liability ratio ($Levi_{i,t}$), and Tobin's Q ($TobinsQ_{i,t}$). Net operating cash flow (CF) refers to the net cash flow from operations, cash dividend (Div) is the product of cash dividend per share before tax and the number of shares outstanding, and cash holdings (Cash) are the cash or cash-equivalent items on the balance sheet. The asset-liability ratio (Lev) and Tobin's Q (TobinsQ) are obtained from the CSMAR database. Next, we allocate scores of 1 and 0 to the KZ index values. KZ1 equals 1 if $CF_{i,t}/Ai_{t-1}$ is lower than the median, and 0 otherwise. KZ2 and KZ3 are equal to 1 if $Div_{i,t}/Ai_{t-1}$ and $Cash_{i,t}/Ai_{t-1}$ are lower than the median, respectively, and 0 otherwise. KZ4 and KZ5 are equal to 1 if $Levi_{i,t}$ and $TobinsQ_{i,t}$ are respectively higher than their medians, and 0 otherwise. We then calculate a KZ index for each year, which is equal to $KZ1 + KZ2 + KZ3 + KZ4 + KZ5$. To construct a measurement model for the KZ index, we use an Ordered Logistic Regression (OLR) to regress $CF_{i,t}/Ai_{t-1}$, $Div_{i,t}/Ai_{t-1}$, $Cash_{i,t}/Ai_{t-1}$, $Levi_{i,t}$, and $TobinsQ_{i,t}$ with the KZ index as the dependent variable and estimate the regression coefficients of the variables. We then use the measurement results to estimate the degree of firm financing constraints. The OLR model is developed as follows.

$$KZ_{i,t} = \alpha_1 \frac{CF_{i,t}}{A_{i,t-1}} + \alpha_2 \frac{Div_{i,t}}{A_{i,t-1}} + \alpha_3 \frac{Cash_{i,t}}{A_{i,t-1}} + \alpha_4 Levi_{i,t} + \alpha_5 TobinsQ_{i,t} + \epsilon_{i,t} \tag{Equ. 2}$$

Table 8 reports our test results with firm financing constraint control, further supporting our primary test results.

Fourth, we adopt Heckman's two-stage regression to address sample self-selection bias. In the first stage, we adopt the Probit test, where *Reform* is the dependent variable and the natural logarithm of firm numbers participating in the Reform (*IVI*) in the same industry and year as well as other control variables in previous tests, to obtain the Inverse Mill's Ratio (IMR). In the second stage, we add IMR to Equ.1 tests. Columns (1) and (2) of Table 9 suggest that *Reform* is still significantly and positively related to $\Delta Lnpatent$. Furthermore, the coefficient of IMR is not significant towards $\Delta Lnpatent$, suggesting that self-selection is not an outstanding issue in our primary tests.

Variable	(1) Full sample $\Delta \ln patent$	(2) Political connections $\Delta \ln patent$	(3) Non-political connections $\Delta \ln patent$	(4) Bank connections $\Delta \ln patent$	(5) Non-bank connections $\Delta \ln patent$	Mixed- ownership reform and non- SOE innovation
<i>Reform</i>	0.5774*** (7.70)	0.4015** (2.33)	0.7348*** (8.67)	0.4331** (2.59)	0.7539*** (8.78)	
Controls	Yes	Yes	Yes	Yes	Yes	
Year	Yes	Yes	Yes	Yes	Yes	
Ind.	Yes	Yes	Yes	Yes	Yes	
Constant	0.4954 (0.45)	5.3859** (2.23)	−0.8599 (−0.71)	5.3443** (2.29)	−1.0137 (−0.83)	
<i>N</i>	654	204	450	214	440	
R^2 _Adj	0.155	0.0864	0.256	0.0691	0.261	
<i>F</i>	3.013	2.371	3.581	2.298	3.594	
Chow test		0.026		0.061		

Note(s): Table 8 reports our measurement results through $\Delta \ln patent = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Variables are as defined in Table 2. ***, **, and * respectively indicate significance level at 1, 5, and 10%

Source(s): Table by authors

Table 8.
Sample bias test results

Variable	Heckman	
	(1) 1st stage <i>Reform</i>	(2) 2nd stage $\Delta \ln patent$
<i>Reform</i>		0.3483** (2.10)
<i>IV1</i>	0.2553*** (2.96)	
<i>IV2</i>		
<i>IMR</i>		−2.0177 (−1.06)
Controls	Yes	Yes
Year	Yes	Yes
Ind.	Yes	Yes
Constant	0.1024 (0.05)	2.8009 (1.03)
<i>N</i>	654	654
Wald χ^2		31.70

Note(s): *IV1* is the natural logarithm of firm numbers participating in the Reform in the same industry and year. *IMR* is the Inverse Mill's Ratio achieved from our probit test. Controls are the same in our previous tests. ***, **, and * respectively indicate significance level at 1, 5, and 10%

Source(s): Table by authors

Table 9.
Two-stage test results

5. Mechanism tests

Following our discussion in 2.2, the Reform may help firms ease financing constraints on innovation by reducing debt financing costs, obtaining tax incentives, government subsidies, etc. As a result, we examine the mechanisms underlying our primary findings from the perspectives of financing constraints, debt financing cost, tax incentives and government subsidy through mediation tests.

5.1 Financing constraints and debt financing costs

We examine the Reform and firm financing constraints. The KZ index can be the most suitable indicator of financing constraints in most business scenarios (Kaplan & Zingales, 1997; Lamont, Polk, & Saa-Requejo, 2001) [9]. The smaller the value of the KZ index, the lower the degree of a firm's financing constraints. The proxy of financing constraints (ΔKZ) is measured as (the KZ in the year following the acquisition of state ownership – the KZ in the year before the acquisition of state ownership). Columns (1) and (2) of Table 10 report our KZ index test results, which suggest that the Reform may significantly alleviate financing constraints of non-SOEs and lead to more innovation outputs.

We further examine the Reform and firm financing costs. The proxy of financing costs ($\Delta Cost$) is measured as (the debt financing costs in the year following the acquisition of state ownership – debt financing costs in the year before the acquisition of state ownership). Columns (3) and (4) indicate that the Reform is significantly and negatively related to financing cost, and financing cost is significantly and negatively related to innovation. In other words, the financing cost intermediates between Reform and innovation.

5.2 Tax incentives and government subsidies

We also examine tax incentives and government subsidies. Tax incentives (ΔTax) are measured as (tax burden in the year following the acquisition of state ownership – tax burden in the year before the acquisition of state ownership), where tax burden = (income tax – deferred income tax)/(pretax profit – deferred tax)/tax rate] (Shevlin, 1987). Government subsidies (ΔGS) are measured as (government subsidies in the year after the acquisition of state ownership – government subsidies in the year before the acquisition of state ownership). Columns (5) and (7) in Table 10 indicate that the Reform is significantly and negatively related to ΔTax but significantly and positively related to ΔGS . Columns (6) and (8) of Table 10 report the results of the mediating effect, indicating that tax incentives and government subsidies play a mediating role. These results suggest that acquiring state ownership under the Reform can promote innovation through access to tax incentives and government subsidies.

5.3 Governance and accounting information quality

We also examine agency cost and accounting information quality, which may give evidence of the mechanism. The proxy of agency cost ($Acost$) is measured as (overhead rates in the year following the acquisition of state ownership). Following Dechow, Sloan, and Amy (1995), we develop a modified Jones model to examine accrued earnings management within firms.

$$\frac{TA_{i,t}}{Asset_{i,t}} = \alpha_1 \frac{1}{Asset_{i,t}} + \alpha_2 \frac{PPE_{i,t}}{Asset_{i,t}} + \alpha_3 \frac{IA_{i,t}}{Asset_{i,t}} + \frac{\Delta REV_{i,t} - \Delta REC_{i,t}}{Asset_{i,t}} + \varepsilon_{i,t} \quad (\text{Equ. 3})$$

where TA is the total accrued profit, measured as the net profit minus the cash flow from operating activities. $Asset$ is the total assets. ΔREV is the main business income of the year minus that in the previous year. ΔREC is the accounts receivable of the year minus that in the previous year. IA is the sum of the original intangible asset value and that of other long-term assets. PPE is the total fixed assets. The absolute value of accrued earnings management in the year following the acquisition of state ownership is the proxy of the accounting information quality. A smaller absolute value corresponds to higher accounting information quality. Columns (1) and (2) in Table 11 report our test results. These results show that Reform is significantly and negatively related to agency cost and earnings management. This indicates that non-SOEs acquiring state ownership under the Reform can improve their governance and enhance their accounting information quality.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	Full sample ΔKZ	Full sample $\Delta lnpatent$	Full sample $\Delta Cost$	Full sample $\Delta lnpatent$	Full sample ΔTax	Full sample $\Delta lnpatent$	Full sample ΔGS	Full sample $\Delta lnpatent$
<i>Reform</i>	-1.8227* (1.74)	0.5814*** (7.74)	-0.0533* (-1.79)	0.5672*** (7.75)	-0.0646** (-2.01)	0.5709*** (7.78)	0.0062*** (3.28)	0.5655*** (7.80)
ΔKZ		-0.1224** (-2.17)						
$\Delta Cost$				-0.5153** (-2.15)				
ΔTax					-0.1446* (-1.78)			
ΔGS								1.2057* (1.76)
<i>Lnage</i>	7.7634** (2.41)	-0.0927 (-0.94)	-0.0404 (-0.65)	-0.0803 (-0.86)	-0.0272 (-0.66)	-0.0809 (-0.87)	-0.0028 (-1.16)	-0.0830 (-0.89)
<i>Lnsize</i>	-3.1811** (-2.06)	-0.0465 (-0.99)	-0.0656** (-2.13)	-0.0453 (-0.98)	-0.0413** (-2.03)	-0.0462 (-1.00)	0.0103*** (8.70)	-0.0319 (-0.65)
<i>Growth</i>	-1.5844 (-0.97)	0.0933* (1.88)	0.0432 (1.32)	0.1017** (2.07)	-0.0055 (-0.26)	0.1008** (2.06)	-0.0017 (-1.34)	0.0990** (2.02)
<i>Power</i>	1.9906 (1.53)	-0.0384 (-0.97)	-0.0587** (-2.25)	-0.0443 (-1.13)	-0.0058 (-0.34)	-0.0436 (-1.12)	0.0016 (1.61)	-0.0414 (-1.06)
<i>RoA</i>	-42.1112 (-1.36)	1.8595** (1.98)	0.4432 (0.72)	2.0674** (2.24)	0.1908 (0.47)	2.0692** (2.24)	0.0394* (1.66)	2.1081** (2.28)
<i>Lev</i>	2.8950 (0.33)	-0.1008 (-0.38)	1.8780*** (10.76)	0.0020 (0.01)	0.2728** (2.37)	-0.0145 (-0.06)	-0.0017 (-0.25)	-0.0287 (-0.11)
<i>Indro</i>	-12.2824 (-0.52)	1.5142** (2.11)	-0.3482 (-0.74)	1.4399** (2.04)	-0.1265 (-0.41)	1.4396** (2.04)	-0.0200 (-1.10)	1.4212** (2.02)
<i>Lnboard</i>	2.1916 (0.30)	0.1848 (0.82)	-0.1957 (-1.34)	0.1897 (0.86)	-0.0328 (-0.34)	0.1912 (0.87)	0.0019 (0.33)	0.1949 (0.89)
<i>Ratio</i>	0.1753 (0.50)	0.0127 (1.19)	-0.0069 (-1.00)	0.0113 (1.09)	0.0040 (0.88)	0.0116 (1.12)	0.0001 (0.39)	0.0115 (1.11)
<i>Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Ind.</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	54.2632 (1.51)	0.3513 (0.32)	1.3772* (1.93)	0.1869 (0.17)	0.8432* (1.79)	0.2036 (0.19)	-0.2094*** (-7.60)	-0.0866 (-0.08)
<i>N</i>	654	654	654	654	654	654	654	654
R^2_Adj	0.0310	0.152	0.310	0.146	0.0143	0.146	0.249	0.147
<i>F</i>	2.357	2.967	6.148	2.924	2.166	2.928	4.791	2.936

Note(s): Column (1) reports measurement results through $\Delta KZ = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. ΔKZ is measured as (the KZ in the year following the acquisition of state ownership – KZ in the year prior to the acquisition of state ownership). Column (2) reports measurement results through $\Delta lnpatent = \alpha_0 + \alpha_1 Reform + \alpha_2 \Delta KZ + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Column (3) reports measurement results through $\Delta Cost = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. $\Delta Cost$ is measured as (the debt financing costs in the year following the acquisition of state ownership – debt financing costs in the year prior to the acquisition of state ownership). Column (4) reports measurement results through $\Delta lnpatent = \alpha_0 + \alpha_1 Reform + \alpha_2 \Delta Cost + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Column (5) reports measurement results through $\Delta Tax = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. ΔTax is measured as (tax burden in the year following the acquisition of state ownership – tax burden in the year prior to the acquisition of state ownership), where tax burden = (income tax – deferred income tax)/(pretax profit – deferred tax)/tax rate (Shevlin, 1987). Column (6) reports measurement results through $\Delta lnpatent = \alpha_0 + \alpha_1 Reform + \alpha_2 \Delta Tax + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Column (7) reports our measurement results through $\Delta GS = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Variables except ΔGS are as defined in Table 2. ΔGS is measured as (government subsidies in the year after the acquisition of state ownership – government subsidies in the year prior to the acquisition of state ownership). Column (8) reports measurement results through $\Delta lnpatent = \alpha_0 + \alpha_1 Reform + \alpha_2 \Delta GS + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Variables except ΔGS are as defined in Table 2. ***, **, and * respectively indicate significance level at 1, 5, and 10%

Source(s): Table by authors

Table 10.
Mechanism test results

Variable	(1) Full sample <i>Acost</i>	(2) Full sample <i>ABSEM</i>	(3) Full sample <i>Credit_loan</i>	(4) Low debt guarantee <i>Credit_loan</i>	(5) High debt guarantee <i>Credit_loan</i>
<i>Reform</i>	−0.0075* (1.79)	−0.0107* (1.88)	0.0138* (1.80)	0.0372* (1.83)	−0.0025 (−0.07)
<i>Lnage</i>	0.0097 (1.31)	−0.0164 (−1.17)	−0.0204 (−0.58)	0.0029 (0.05)	−0.0427 (−0.91)
<i>Lnsize</i>	−0.0091** (−2.47)	−0.0152** (−2.19)	0.0591*** (3.40)	0.0568* (1.80)	0.0620*** (2.71)
<i>Growth</i>	−0.0013 (−0.32)	−0.0146** (−1.97)	−0.0384** (−2.09)	−0.0336 (−1.42)	−0.0498 (−1.46)
<i>Power</i>	0.0069** (2.21)	−0.0049 (−0.81)	−0.0467*** (−3.18)	−0.0456** (−2.31)	−0.0363 (−1.45)
<i>RoA</i>	−0.2761*** (−3.76)	0.2582* (1.84)	0.4192 (1.21)	0.5031 (0.86)	0.4229 (0.92)
<i>Lev</i>	−0.1081*** (−5.19)	0.0936** (2.37)	−0.0698 (−0.71)	−0.1165 (−0.69)	−0.0142 (−0.11)
<i>Indro.</i>	−0.0870 (−1.55)	0.0417 (0.40)	0.0253 (0.10)	0.0503 (0.12)	−0.0921 (−0.26)
<i>Lnboard</i>	0.0007 (0.04)	0.0203 (0.62)	−0.1840** (−2.23)	−0.2128 (−1.57)	−0.1815 (−1.61)
<i>Ratio</i>	−0.0023*** (−2.79)	0.0022 (1.40)	0.0022 (0.56)	0.0028 (0.44)	0.0021 (0.39)
<i>Year</i>	Yes	Yes	Yes	Yes	Yes
<i>Ind</i>	Yes	Yes	Yes	Yes	Yes
Constant	0.3407*** (3.99)	0.4452*** (2.79)	−0.6362 (−1.58)	−0.4463 (−0.65)	−0.7467 (−1.41)
<i>N</i>	654	654	654	285	369
<i>R</i> ² _Adj	0.377	0.122	0.0593	0.0633	0.0549
<i>F</i>	7.936	2.604	2.722	2.343	2.419

Note(s): Column (1) reports measurement results through $Acost = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Variables except *Acost* are as defined in Table 2. *Acost* is measured as (overhead rates in the year following the acquisition of state ownership). Column (2) reports measurement results through $ABSEM = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Variables except *ABSEM* are as defined in Table 2. Columns (3), (4), (5) report measurement results through $Credit_loan = \alpha_0 + \alpha_1 Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$. Variables except *Credit_loan* are as defined in Table 2. *Credit_loan* is measured as (credit loans/total borrowings). ***, **, and * respectively indicate significance level at 1, 5, and 10%.

Source(s): Table by authors

Table 11.
Other mechanism test results

5.4 Debt guarantee

Since China has a bank-dominated financial system (Xu & Lin, 2007; Xu et al., 2016, 2022, 2023), we examine the relationship between the Reform and bank trust in non-SOEs. If the Reform significantly increases the ratio of credit loans to non-SOEs, enhanced bank trust in non-SOEs may be another element underlying our primary findings. The ratio of credit loans (*Credit_loan*) is measured as (credit loans/total borrowings). Columns (3) in Table 11 report our test result, and the Reform is significantly and positively related to credit loans. Banks and other creditors often base their risk expectations on tangible assets such as collateral (Fisher, 1959; Ma et al., 2023; Wu, Xu et al., 2023; Xu, Li, Ma, & Liu, 2023). Following Williamson (1988) and Harris and Raviv (1990), we use the ratio of tangible assets, measured as (inventory + fixed assets)/total assets, as an indicator of debt guarantee capacity, subgroup our sample firms by the median of the indicator, and re-do our tests. Columns (4) and (5) in Table 11 report test results on low- and high-debt guarantee capacity groups, respectively. These results suggest that the Reform is significantly and positively related to

credit loans for the low debt guarantee capacity group, but not significantly related to the high debt guarantee capacity group. The results show that non-SOEs acquiring state ownership under the Reform can gain better trust from banks.

6. Extended discussion

In this section, we examine the moderation effects of factors, i.e. COCs of firm executives, government intervention, and marketisation, affecting the link between the Reform and innovation amongst non-state-owned acquiring firms. We also briefly discuss the economic consequences of the Reform.

6.1 Executives' COCs

Non-state-owned firm executives [10] may have connections with SOEs, i.e. they have been SOE executives. SOE background may affect the decisions of executives on acquiring state ownership. COCs may serve as an informal information conduit for better communication between the firms and their potential targets. They may allow the firms to better familiarise themselves with the operation of their potential targets. In addition, COCs may allow better bidding to acquire state ownership and better integrate the acquirer firms with target firms after M&As. For such reasons, we examine the COCs of non-state-owned acquirer firm executives and their moderation effect [11]. Column (1) in Table 12 reports that *COC_Reform* is significantly and positively related to innovation, suggesting that the COCs of executives may strengthen the impact of the Reform on non-SOE innovation.

6.2 Marketisation

Considering the uneven development of regions in the country and the fact that non-SOEs, as well as financial institutions, often demonstrate regional features in their operations, we further examine the moderation effect of regional marketisation by adopting the Marketization index of China's provinces: NERI Report 2018; Wang and Fan (2018) [12]. Column (2) in Table 12 reports that *Market_Reform* is significantly and negatively related to innovation, suggesting that marketisation weakens the impact of the Reform on the innovation of non-state-owned acquirer firms. This result may be related to the poor accounting information quality of non-SOEs in less developed areas, where banks must rely more on firm ownership rather than accounting information in their lending practices. By participating in the Reform, non-SOEs may overcome the ownership bias and access more resources.

6.3 Government intervention

We further examine the moderating effect of government intervention on the Reform's impact on innovation by non-SOEs. The government always plays an important role in allocating key resources and intervening in the market (Frye & Shleifer, 1997). Government intervention is also significantly visible amongst M&As in China (Li, Xu *et al.*, 2020, 2022), which may also affect non-SOE decisions. Considering that government intervention may also differ from region to region, we examine the moderation effect of the regional government-to-market relationship by adopting the Marketization index of China's provinces: NERI Report 2018; Wang and Fan (2018) [13]. Column (3) in Table 12 reports that *Intervention_Reform* is significantly and positively related to innovation, suggesting that government intervention strengthens the impact of the Reform on non-state-owned acquirer firm innovations. This result may be related to the fact that the government controls more resources in areas of more government intervention. The Reform helps non-SOEs access more government-controlled resources required by innovation.

Variable	(1) Full sample $\Delta \ln patent$	(2) Full sample $\Delta \ln patent$	(3) Full sample $\Delta \ln patent$	(4) Full sample $\Delta TobinQ$	(5) Full sample $\Delta TobinQ$
<i>Reform</i>	0.5576*** (7.66)	0.5525*** (7.64)	0.5682*** (7.76)	0.2525*** (2.90)	0.2099** (2.28)
<i>COC</i>	0.1545** (2.03)				
<i>COC_Reform</i>	0.1478 (1.05)				
<i>Market</i>		−0.5211*** (−3.65)			
<i>Market_Reform</i>		0.2529*** (3.33)			
<i>Intervention</i>			0.0743 (0.52)		
<i>Intervention_Reform</i>			0.0082 (0.10)		
$\Delta \ln patent$					0.0284* (1.79)
<i>Reform_Δlnpatent</i>					0.0651** (2.02)
<i>Lnage</i>	−0.0881 (−0.94)	−0.0834 (−0.90)	−0.0758 (−0.81)	0.0667 (0.60)	0.0643 (0.57)
<i>Lnsize</i>	−0.0480 (−1.04)	−0.0366 (−0.80)	−0.0444 (−0.96)	−0.3202*** (−5.80)	−0.3232*** (−5.85)
<i>Growth</i>	0.1071** (2.19)	0.0980** (2.03)	0.1009** (2.06)	−0.0686 (−1.18)	−0.0608 (−1.05)
<i>Power</i>	−0.0442 (−1.14)	−0.0419 (−1.09)	−0.0426 (−1.08)	0.2556*** (5.52)	0.2526*** (5.45)
<i>Roa</i>	2.0578** (2.24)	1.9410** (2.13)	2.0353** (2.16)	4.1498*** (3.78)	4.2821*** (3.88)
<i>Lev</i>	−0.0195 (−0.08)	−0.0032 (−0.01)	−0.0220 (−0.08)	−0.4439 (−1.42)	−0.4520 (−1.45)
<i>Indro</i>	1.3852** (1.98)	1.3262* (1.91)	1.4442** (2.05)	−1.6593** (−1.97)	−1.5909* (−1.88)
<i>Lnboard</i>	0.2088 (0.95)	0.1431 (0.66)	0.1916 (0.87)	0.0455 (0.17)	0.0579 (0.22)
<i>Ratio</i>	0.0119 (1.16)	0.0123 (1.20)	0.0116 (1.12)	−0.0018 (−0.15)	−0.0011 (−0.09)
Year	Yes	Yes	Yes	Yes	Yes
Ind	Yes	Yes	Yes	Yes	Yes
Constant	0.1512 (0.14)	0.0445 (0.04)	0.1522 (0.14)	9.0203*** (7.04)	9.0375*** (7.04)
<i>N</i>	654	654	654	654	654
<i>R²_Adj</i>	0.156	0.169	0.145	0.390	0.390
<i>F</i>	3.044	3.253	2.877	8.075	7.840

Note(s): Column (1) reports measurement result through $\Delta \ln patent = \alpha_0 + \alpha_1 Reform + \alpha_2 COC + \alpha_3 COC_Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Column (2) reports measurement result through $\Delta \ln patent = \alpha_0 + \alpha_1 Reform + \alpha_2 Market + \alpha_3 Market_Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Column (3) reports our measurement result through $\Delta \ln patent = \alpha_0 + \alpha_1 Reform + \alpha_2 Intervention + \alpha_3 Intervention_Reform + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Column (4) reports measurement result through $\Delta TobinQ = \alpha_0 + \alpha_1 Reform + \alpha_2 \Delta \ln patent + \alpha_3 Reform_ \Delta \ln patent + \Sigma Controls + \Sigma Year + \Sigma Ind + \varepsilon$ (Equ 0.1). Variables are as defined in Table 2. ***, **, and * respectively indicate significance level at 1, 5, and 10%

Source(s): Table by authors

Table 12.
Moderation effect:
examination results

6.4 Economic consequence

We additionally examine the changes in firm value after improved innovation of non-SOEs under the Reform. Non-SOEs often choose M&As to increase firm value (Chemmanur & Tian, 2018). For this purpose, we use change in firm value ($\Delta TobinQ$), measured as (Tobin's Q in the third year after the acquisition of state ownership – Tobin's Q in the year before the acquisition of state ownership), to examine the economic consequence. Columns (4) and (5) in Table 12 report that both *Reform* and *Reform_Δlnpatent* are significantly and positively related to $\Delta TobinQ$, suggesting that the Reform not only improves their innovation but also their value.

7. Conclusion

Non-state-owned enterprise innovation is crucial for a country's economic growth and competitiveness. However, non-SOEs often face significant financing constraints due to poor accounting information quality, lack of tangible assets as collateral, traditional bank bias, and more. This study sheds light on the historical Reform and its impact on non-SOE innovation. The Reform helps to alleviate financing constraints by providing access to financial resources through political and bank connections, improving firm governance, enhancing debt guarantee capacity, and increasing access to government resources. Financing costs, government subsidies, and tax incentives may play intermediary roles. The impact of the Reform on non-SOE innovation is further strengthened by the SOE background of a non-SOE executive or local government intervention, whilst regional marketisation may weaken it. Nonetheless, further research is needed to explore the association between mixed ownership reform and non-SOE innovation with firms of low economic and political status in greater detail.

Our findings may have several policy implications. First, the Reform may provide non-SOEs with an effective means to alleviate financing constraints for innovation. Non-SOEs, especially those with high financing constraints, low accounting information quality, or less collateral, may enhance their innovation capabilities by acquiring state equity. Such a practice can provide a useful reference to non-SOEs in developing countries. Second, the Reform may effectively substitute political and bank connections, which are traditionally meaningful towards firm innovation. Non-SOEs with poor political or bank connections may, through the Reform, significantly alleviate their financing constraints and develop innovation capabilities. Third, executives of non-SOEs with government backgrounds and government intervention may help promote the positive link between the Reform and the innovation capabilities of non-SOEs. In emerging markets, it may be necessary for the government to improve market access conditions for non-SOEs and limit its involvement in allocating resources to state-owned enterprises. Fourth, the Reform highlights the possibility of using effective policy design to encourage innovation by non-SOE entrepreneurs, which is crucial for long-term economic prosperity in the Asian region. Mixed ownership and the construction of diversified markets to alleviate financing constraints of non-state-owned companies may be effective solutions to sustain economic growth in the long term.

Our study highlights the need for further research extensions. Due to the constraints imposed by our data and methodology, it is necessary to conduct more comprehensive theoretical and empirical investigations into the relationship between mixed ownership reform and firm innovation, particularly for firms with low economic and political status. This would involve a detailed analysis of the extent to which the Reform provides increased access to state-controlled resources, financing opportunities for non-state-owned acquirer firms, and the duration of such access. Further research can help provide a more nuanced understanding of the Reform's impact on innovation in emerging markets.

1. The Reform encourages non-SOE capital into SOEs or state capital into non-SOEs, which can be seen as a step towards market-oriented reforms and increased participation of the private sector in the economy. In the meantime, the Reform does not always result in complete privatisation of state-owned assets. The government continues to play a significant role in strategic decision-making and maintains control over crucial sectors, such as mining, energy, telecommunications, finance, etc. Our study focuses on the non-SOEs' acquisitions of SOEs. Given data constraints, we do not distinguish whether non-SOEs send directors, executives or supervisors to participate in corporate governance in our theoretical analysis and empirical tests.
2. As anecdotal evidence, Yuwell Medical (SZ 002223) is a listed non-SOE on the Shenzhen Stock Exchange. In 2014, it acquired, by cash, 51.2% of equity of Wandong Medical (SZ 600055, an SOE listed on the Shanghai Stock Exchange). Following the takeover, Yuwell Medical reported sharply declined financing constraints or debt costs. Its innovation also seems enhanced from 39 patent applications in 2015 to that of 117 in 2019.
3. In this study, COCs refer to the connections of private firm executives with SOEs.
4. Given that non-SOEs have been acquiring state ownership only since 2010 and there is a lagging effect for firm innovation, where we adopt $t+2$ measurements, our datasets cover listed A-share firms between 2009 and 2019. The COVID-19 Pandemic in 2020 also requires us to confine our sample period as suggested above.
5. Listed firms commonly disclose their ultimate controllers. This practice allows us to judge firm ownership type straightforward. Non-listed target firms can be identified in acquirer disclosures, the ultimate controllers of which can be further identified through firms' annual reports, Baidu, and [Tianyancha.com](https://www.tianyancha.com) searches. If the ultimate controller of a firm is an individual, then the firm is categorised as non-SOE.
6. For such a purpose, we adopt firm annual reports, Baidu and [Tianyancha.com](https://www.tianyancha.com) searches.
7. Given that target firms are disclosed in acquirer's announcements, we can identify the ultimate controller and ownership type through such searches.
8. In China, patent applications are disaggregated into invention, utility, and design types. Respectively, we use the logarithm of each type of patent applications in the second year following the acquisition minus the logarithm of this type of patent applications, i.e. $\Delta \ln \text{patent1}$, $\Delta \ln \text{patent2}$, and $\Delta \ln \text{patent3}$ to represent changes in these three types of patent applications.
9. The existing literature suggests three main ways to measure firm financing constraints: investment-cash flow sensitivity and cash-cash flow sensitivity, single financial indicators such as dividend payout ratio or firm size, and indices such as the KZ index, WW index, and SA index (Kaplan & Zingales, 1997; Whited & Wu, 2006; Hadlock & Pierce, 2010; Lamont *et al.*, 2001). The WW index uses the generalised method of moments (GMM) and Euler equation, which have strict data requirements and limited applications. On the other hand, the SA index only considers firm size and age variables, and its effectiveness has been questioned (Hadlock & Pierce, 2010). In contrast, the KZ index uses an ordered logistic model and is appropriate in most situations, as it encompasses cash, cash flow, and other financial indicators (Kaplan & Zingales, 1997; Lamont *et al.*, 2001). Given the research question and the scenarios appropriate for this study, we have decided to use the KZ index as our measure of financing constraints.
10. Here we broadly include board directors, supervisory board members, and senior executives.
11. We manually collect executives' COC information from firm disclosures, Baidu and Google searches. We define firm executives' COC dummy as 1 if SOE background identified, and 0 otherwise.
12. We assign 1 to regions of better marketisation and 0 to those of less marketisation.
13. We assign 1 to regions of stronger government intervention and 0 to those of weaker intervention.

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