



State governance and technological innovation in emerging economies: State-owned enterprise restructuring and institutional logic dissonance in China's high-speed train sector

Aurora Liu Genin¹, Justin Tan²
and Juan Song³

¹Isenberg School of Management, University of Massachusetts Amherst, 121 President's Drive, Amherst, MA 01002, USA; ²Schulich School of Business, York University, 4700 Keele Street, Toronto, ON M3J 1P3, Canada; ³School of Business, Central South University, Changsha, Hunan, China

Correspondence:

J Song, School of Business, Central South University, Changsha, Hunan, China
e-mail: songcsu2011@126.com

Abstract

Can state governance spur firm innovation in an emerging economy and transform state-owned enterprises (SOEs) from “dying dinosaurs” to “dynamic dynamos”? We seek an answer to this question by investigating the innovative performance of restructured SOEs in China's high-speed train sector. We expect that SOE restructuring will improve firm innovation, but that the degree of improvement will depend on how the state conducts firm governance. Building on institutional theory, we distinguish state governance via equity ownership and administrative affiliation in an emerging economy with market-hierarchy institutional conflicts. Under such conflicts, restructured SOEs experience *institutional logic dissonance*, which hinders organizational change for technological innovation. We hypothesize that state ownership exacerbates institutional logic dissonance at a restructured SOE, thus limiting innovation improvement from restructuring; in contrast, state affiliation mitigates firm dissonance and hence augments such improvement. We find empirical evidence for these hypotheses in a comprehensive panel of high-speed train manufacturers in China between 1989 and 2015. This study contributes to the institution-based theory of technological innovation in emerging economies. On the practical front, our findings suggest that emerging states may adopt arms-length governance to spur SOE innovation and unleash these dynamic dynamos to fuel sustainable economic growth.

Journal of International Business Studies (2020).

<https://doi.org/10.1057/s41267-020-00342-w>

Keywords: institutional theory; corporate governance in emerging markets; innovation and R&D; SOE restructuring; administrative affiliation; Chinese high-speed train

INTRODUCTION

Around the world, state-owned enterprises (SOEs) are major economic players, especially in emerging economies (Tan & Tan, 2005, 2017; Zhou, Gao, & Zhao, 2017). State governments in the emerging world have undertaken considerable restructuring of



their SOEs in the attempts to develop firm competencies (Musacchio, Lazzarini, & Aguilera, 2015), including those in technological innovation (e.g., Liang, Ren, & Sun, 2015; Musacchio et al., 2015; Zhou, Tse, & Li, 2006). The results from such attempts have varied, and it remains unclear why in the literature (Musacchio et al., 2015). In a parallel stream, research has shown that state governance – through equity ownership or administrative affiliation – may enhance firm innovation by facilitating resource access, but that state-governed firms may be less innovative due to low efficiency at which they use critical resources (e.g., Li, Xia, & Zajac, 2018; Zhou et al., 2017; Jia, Huang, & Zhang, 2019).

State ownership and affiliation not only provide resources but also exert institutional pressure on the firm (Mahmood & Rufin, 2005; Tan, 2002; Meyer & Peng, 2016; Ramamurti & Hillemann, 2018; Buckley, Clegg, Voss, Cross, Liu, & Zheng, 2018). In her seminal article, Oliver (1991) argues that organizational responses to institutional pressure may elicit misalignments in a firm's internal institutional logics, which will hamper positive organizational changes. In the same vein, Pache and Santos (2010) argue that the mechanism by which a firm receives institutional pressure delineates how the firm reconciles misaligned institutional logics for change implementation. We posit that state ownership and affiliation represent two distinct mechanisms to convey pressure from the state, thus yielding unique impacts on how a firm implements positive changes in SOE restructuring.

While SOE restructuring has been undertaken to tap into market forces that spur technological innovation in emerging economies, state governance remains influential on firm development of innovation competencies (Tan & Tan, 2005; Zhou et al., 2006, 2017). However, the literature has yet to unpack the distinction between state governance via ownership versus affiliation. This has hindered theoretical understanding on how different state governance approaches may affect technological innovation in emerging economies. Consequently, we do not know why some restructured SOEs in post-reform emerging economies flourish as “dynamic dynamos” and why others fail and end up being “dying dinosaurs” (Ralston, Terpstra-Tong, Terpstra, Wang, & Egri, 2006).

We fill this knowledge gap by distinguishing between the impacts of state ownership and state affiliation on the effectiveness of SOE

restructuring to improve firm innovation. We build on the institutional logic framework to conceptualize different mechanisms for these impacts. We start by extending the institutional framework of demand conflicts (Kraatz & Block, 2008; Oliver, 1991) to analyze the contradictory demands of market and hierarchy on firm innovation. We highlight how firms have adapted and how that has affected firm innovation. Through the lens of institutional logic (Pache & Santos, 2010), we explain how internal and external state influences may facilitate or hinder adaptation. We find empirical evidence supporting our hypotheses by looking at the Chinese high-speed train sector from 1989 to 2015. Although we focus on China, we believe that our findings are applicable to many of the emerging economies that are undertaking economic reforms. These reforms have predominantly led to state capitalism, an institutional system that is rife with market-hierarchy conflicts and characterized by state influence on the firm (Bruton, Peng, Ahlstrom, Stan, & Xu, 2015; Chang, 2007; Mariotti & Marzano, 2019). Our conceptual development yields generalizable insights on the “double-edged sword” of state governance on firm innovation in emerging economies.

This study contributes to the body of research on technological innovation in emerging economies. Using *institutional logic dissonance*, we distinguish between the impacts on innovation of state ownership vs. state affiliation. We conceptualize the underlying mechanisms that explain the differing effects from an institutional perspective. Our findings support our hypotheses, allowing us to contribute to a better understanding of “the exact nature and governance structure of a Chinese company” (Buckley et al., 2018, p. 14) and to illustrate how state governance affects technological innovation under institutional complexity (Jia et al., 2019). We show that institutional theory can complement the resource-based approach to the study of state influence on technological innovation in emerging economies (e.g., Li et al., 2018; Zhou et al., 2017; Meyer & Peng, 2016).

THEORETICAL BACKGROUND

Technological innovation is central to free-market competition. It “sets and keeps the capitalist engine in motion” (Schumpeter, 1942, p 82). Many emerging countries have undertaken economic reforms to replace the hierarchy-based socialistic regimes with market-based institutions in the hope that



free-market competition will deliver higher economic growth (Mariotti & Marzano, 2019; Musacchio et al., 2015). These reforms have emphasized the development of technological innovation by, for instance, protecting intellectual property (Peng, Ahlstrom, Carraher, & Shi, 2017). However, post-reform institutional complexities, such as those stemming from competing institutions, may hinder innovation (Peng et al., 2017).

The economic reforms undertaken by Brazil, Russia, India and China, and other emerging countries, have resulted in state capitalism, a regime characterized by the co-existence of market-based and hierarchy-based institutions (e.g., Hu, Cui, & Aulakh, 2019; Musacchio et al., 2015; Tan & Litschert, 1994; Tan & Tan, 2005). These institutions clash under state capitalism, forcing firms to attempt to reconcile opposing institutional demands. Pressure to conform is exerted through *regulatory regimes*, *normative orders*, and by *cultural logic* (Kraatz & Block, 2008; Oliver, 1991). This influences the institutional logic of organizations (Thornton, Ocasio, & Lounsbury, 2012), that is, the cultural templates that govern the *means* and *goals* of organizational actors (Friedland & Alford, 1991).

When firms operate in an environment with multiple institutional systems that make contradictory demands, the result is often conflicts in institutional logic and internal struggle (Pache & Santos, 2010; Oliver, 1991). In such an environment, firms will attempt to come to terms with the “inconsistencies between institutional expectations and internal organizational objectives related to efficiency or autonomy” (Oliver, 1991, p. 153). Consequently, firms experience *institutional logic dissonance*, a term we coin to describe the internal struggle of an organization trying to resolve conflicting institutional demands.

While economic reform has been able to spur private-sector innovation in major developing countries (e.g., Filatotchev, Liu, Buck, & Wright, 2009; Liu, Lu, Filatotchev, Buck, & Wright, 2010; Tan & Tan, 2017), the relationship between institutional logic dissonance and firm innovation remains unclear (e.g., Meyer & Peng, 2016; Peng et al., 2017). Scholars have shown that conflicting institutional demands affect organizational outcomes (e.g., D’Aunno, Succi, & Alexander, 2000; Kraatz & Block, 2008; Pache & Santos, 2013). Conflicts between market and hierarchy in post-reform emerging economies are salient due to the state’s prominent influence on private-sector activities. The goal of reform in the emerging world is to

adapt to the market system, and in particular to increase technological innovation (Musacchio et al., 2015). However, dissonance in a firm’s internal institutional logic may thwart that goal.

Under state capitalism, the state exerts crucial influence on firm innovation (Bruton et al., 2015; Hu et al., 2019; Ramamurti & Hillemann, 2018). Zhou et al. (2017) and Tan and Peng (2003) show that state ownership can increase firm R&D productivity because the state provides more resources to state-owned firms than to other firms; but it can also decrease innovative performance as state ownership can reduce the firm’s internal resource utilization efficiency. Li et al. (2018) and Tan (2002) argue that firms which have an administrative affiliation with the central government often receive resources which are critical for innovation, such as financial and human capital, research funding, and access to inter-organizational networks. At the same time, state affiliation can impede the integration of external resources – such as knowledge, thus negating the benefits of market-based organizational designs on firm innovation (Li et al., 2018). These seminal studies show that, under state capitalism, state ownership and state affiliation have a double-edged effect on firm innovation.

State ownership and state affiliation both impose institutional demands on firms (Tan, 2002). Such demands largely represent the hierarchy system and can be at odds with those of the market (Mahmood & Rufin, 2005; Meyer & Peng, 2016). Institutional scholars argue that it makes a difference whether these demands are imposed internally or externally (e.g., DiMaggio & Powell, 1983; Greenwood & Hinings, 1996; Pache & Santos, 2010). Because state influence is exerted internally in the case of state ownership and externally in that of state affiliation (Li et al., 2018; Tan, 2002), state-owned and state-affiliated firms may experience different levels of institutional logic dissonance as they reconcile state influence with market principles. While the literature emphasizes the resource implications of state ownership and state affiliation, it tells us little about how differences in the level of dissonance between state-owned and state-affiliated firms will affect their innovative performance. Thus, we do not know whether state ownership and state affiliation are blessings or curses when attempting to develop technological innovation in emerging economies.

SOE restructuring, including the adoption of market-based practices, is done in an effort to

improve firm innovative performance (Musacchio et al., 2015; Zhou et al., 2006). Since institutional logic dissonance can derail the implementation of such changes (Oliver 1991; Pache & Santos, 2010, 2013), we conjecture that the impact of restructuring on innovative performance depends on whether a firm is state-owned or state-affiliated. We examine dissonance-based contingency effects in this study. First, we show that, under state capitalism, market and hierarchy put contradictory demands on firm innovation. Building on institutional theory, we describe the contradictory demands of regulatory regimes, normative orders, and cultural logic (Kraatz & Block, 2008; Oliver, 1991). Second, we highlight changes brought about through SOE restructuring and look at their implications for innovation. Finally, we distinguish the dissonance-based mechanisms of state ownership and affiliation to shed light on their impacts on the effectiveness of organizational changes for firms under demand conflicts. These mechanisms explain why state ownership and state affiliation influence firm innovation differently.

INSTITUTIONAL DEMAND CONFLICTS: WHEN MARKET AND HIERARCHY COLLIDE

Capitalistic Institutional Demands on Innovation

Regulatory regimes

Under capitalism, the law of supply and demand governs free market competition. Firms that do not innovate must compete with those offering similar product and services. Thus, non-innovating firms risk reduced profitability. On the other hand, innovating firms are able to meet changing market demand with new products and services (Porter, 1991; Schmidt, 1997). Hence, innovation is critical for competitive advantage under free market competition.

Normative orders

The economic and normative forces of capitalism encourage firms to prioritize innovation (Drucker, 1985). Indeed, innovative leaders often receive not only economic rewards but also social recognition (Gorodnichenko & Roland, 2011), while imitators are often badly seen.

Cultural logic

Individualism is emblematic of capitalistic societies, and taking pride in one's distinctiveness is central to the cultural logic that inspires

entrepreneurship and creativity (Schwartz, 1994). Innovation is able to flourish in firms that have an organizational culture that looks favorably on individualism (Gorodnichenko & Roland, 2011; Taylor & Wilson, 2012). In sum, free market competition, normative pressure towards differentiation, and a culture that values individualism and entrepreneurship are important innovation motivators.

Socialistic Institutional Demands on Innovation

Regulatory regimes

According to Schumpeter (1942, p. 83), innovation is a "creative destruction" process "that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one". Innovation causes technological unemployment, bankruptcies, and vanishing industries, which heighten inequality as the distribution of wealth is increasingly skewed towards those who have capabilities and opportunities and are motivated to apply them to the development of innovations.

In a socialistic economic system, on the other hand, central planning replaces the "invisible hand" of the market by its visible hand (Stiglitz, 1991). Under central planning, inputs and outputs are allocated and distributed by governmental agencies (Nee, 1989; Tan & Litschert, 1994). Transactions between firms are coordinated by the Plan and competition is nonexistent (Nee, 1989). Producers of goods and services have no incentive to upgrade their offerings and thus none to innovate.

Normative orders

Central planning emphasizes maintenance of the *status quo* (Hofstede, 2001; Nee, 1989). Prior to the wave of reforms, SOEs were often called upon to fulfill social, political, and administrative responsibilities (Megginson & Netter, 2001). In China, for example, they were responsible for employee housing, healthcare, and retirement benefits (Zhou et al., 2006). Such costly programs not only diminish organizational resources for technological innovation but also coerce managers to conform to the *status quo* in order to remain beneficiaries in these programs (Tan & Litschert, 1994; Zhou et al., 2006).

Cultural logic

In pre-reform China, "iron bowl" referred to highly stable, often lifelong, employment. Guaranteed employment tends to undermine risk-taking as it



might jeopardize job security (Hassard, Rees, Morris, Sheehan, & Xiao, 2010; Liang et al., 2015; Tan & Litschert, 1994). Culturally, central planning follows a collectivistic logic, which puts community welfare above individual interests and attempts to reduce differences between individuals (Hofstede, 2001). Innovation invariably entails differentiation and so is frowned upon in socialist systems, thus such systems provide no economic, social, or cultural incentives to engage in innovation. Table 1 summarizes how differences in regulatory regimes, normative orders, and cultural logic between the capitalist system and the socialist hierarchy influence incentives for innovation.

INSTITUTIONAL LOGIC DISSONANCE AND FIRM INNOVATION: THE INTERPLAY BETWEEN STATE GOVERNANCE AND ORGANIZATIONAL RESTRUCTURATION

Institutional Logic Dissonance: Reconciling Market and Hierarchy Demands

Firms in post-reform emerging economies grapple with conflicting institutional demands. Under state capitalism, state influence remains salient in the private sector alongside market-based rules (Hu et al., 2019; Li et al., 2018; Musacchio et al., 2015). For example, SOEs are often the beneficiaries of favorable state policies (Mahmood & Rufin, 2005; Tan & Tan, 2017; Ramamurti & Hillemann, 2018). Targeted policy-making contrasts significantly with free market competition. The preponderance of the literature shows that adherence to hierarchy-based

regulatory regimes leads to inefficient use of resources needed for technological innovation (Zhou et al., 2017). Political favoritism not only reduces the efficiency of resource utilization but also burdens the firm with conflicts against the interests of economic stakeholders (Li et al., 2018).

Economic reform of the kind we describe also leads to changes in informal institutions, i.e., normative orders and cultural logic. Reform implementation is often done incrementally in recognition of how deeply embedded elements of traditional institutions are in the psyche and heuristics of politicians and firm managers (Kraatz & Block, 2008). When there is a clash between new institutions and traditional ways, managers often lean towards preserving the norms with which they are familiar, that is they resist adopting Western models (Chen & Miller, 2010). SOEs transitioning to a market-based system will often seek a compromise between the norms and cultures of socialistic hierarchy and the dictates of free markets. That results in institutional logic dissonance, which affects firm implementation of SOE restructuring. We examine in the remainder of this section the implication of SOE restructuring for innovation, and contrast two types of state influence on innovation: state ownership and state affiliation.

Organizational Restructuration of SOEs and Firm Innovation

In many emerging economies transitioning into capitalistic market systems, SOEs have undergone structural and managerial transformation (e.g., Kozminski, 1993; Pollitt & Bouckaert, 2004). For

Table 1 Institutional demand conflicts between the capitalistic market and the socialistic hierarchy systems

Institutional dimensions	Capitalistic market	Socialistic hierarchy
<i>Regulatory regimes</i>	<i>Supply and demands</i>	<i>Central planning</i>
Economic participant responses	Competition	Coordination
Institutional demands on innovation	Firm innovation is necessary to maintain supply–demand match and to sustain competitive advantage	Firm innovation is not necessary to carry out coordinated transactions
<i>Normative orders</i>	<i>Facilitating differentiation</i>	<i>Maintaining status quo</i>
Economic participant responses	Developing unique assets	Seeking stable and predictable actions
Institutional demands on innovation	Firm innovation is praised since innovative leaders are more highly regarded than imitative followers	Individuals are coerced to avoid risky innovation
<i>Cultural logics</i>	<i>Individualistic culture</i>	<i>Collectivistic culture</i>
Economic participant responses	Celebrating entrepreneurship and creativity	Emphasizing commonality
Institutional demands on innovation	Firm innovation is nurtured by the organizational culture that aligns with individualism	Innovators receive no encouragement



example, a critical component of China's "open door" economic reforms is to restructure SOEs using the Western corporate model (Hassard et al., 2010). The intention is to develop SOE competitive capabilities by allowing competition between domestic and foreign firms (Tan & Tan, 2005).

Recognizing that private sector innovation is a powerful engine for sustained economic growth (Tan & Tan, 2017; Guan & Yam, 2015; Li et al., 2018), one of the strategic priorities of SOE privatization is the development of innovative competencies. For instance, the central government of China has prioritized SOE restructuring in the high-speed train sector. It has particularly emphasized R&D capabilities and indigenous technological innovation (Sun, 2015). SOE restructuring has had four main goals: changing objectives, redistributing property rights, rebuilding governance structures, and restoring managerial incentives.

Changing objectives

Chinese SOEs have long been required to meet political, social, and economic objectives. The government mandated adherence to the Communist Party's political agenda is a way of reinforcing its power (Groves, Hong, McMillan, & Naughton, 1994). SOEs were tasked with providing social benefits such as housing and healthcare "cradle to grave" as well as salaries and pensions (Hassard et al., 2010). With those obligations to meet, and under the strictures of central planning, SOEs had little motivation to enhance product quality (Groves et al., 1994; Tan & Litschert, 1994). Today's restructured SOEs seek to achieve competitive advantage and growth through product quality, production efficiency, and innovation (Groves et al., 1994; Tan & Tan, 2005; Liang et al., 2015).

Redistributing property rights

The privatization of SOEs has resulted in three main types of ownership structures: SOEs with privately held shares, public-private joint ventures, and publicly listed firms. Privatization has facilitated the forming of capitalistic market institutions, which place strong emphasis on firm innovation (Megginson & Netter, 2001).

Rebuilding governance structures

SOE firm governance has been moved towards the Western "scientific management" model (Groves et al., 1994). Restructured SOEs are quasi-decentralized corporations under hybrid governance

(Hassard et al., 2010; Tan, Li, & Xia, 2007). For example, some SOEs have been made subsidiaries of others with their major investments subject to the approval of the parent SOEs, whereas state representatives supervise those of the parent SOEs (Hassard et al., 2010). Under the hybrid governance structure, the economic functions of SOEs are largely separate from social ones, with restructured SOEs carrying out business activities while government agencies seeing to social welfare.

Most importantly, the state has emphasized SOE economic functions by assigning specific product categories to them (Hassard et al., 2010). Production specialization allows each firm to target a narrow set of technological areas in which they conduct innovation (e.g., Sun, 2015). Product specialization increases firm freedom to optimize resource utilization and thus enhance the efficiency of internal operations, which can improve innovation and profitability (Groves et al., 1994).

Restoring managerial incentives

Prior to restructuring, managers were motivated primarily by political goals. They followed state directives and were promoted in the communist party cadre system (Liang et al., 2015). Thus, they prioritized administrative functions and fulfilling "iron bowl" responsibilities (Hassard et al., 2010). Restructuration has given them the autonomy to decide on firm operations and made them responsible for firm performance (Groves et al., 1994). Their own performance is judged by that of the firm. That is a powerful incentive to break with existing routine and to take some level of risk in an effort to enhance efficiency and product quality. They are investing in R&D, including constructing R&D facilities, using new technologies, recruiting and training skilled workers, and developing new products (Zhou et al., 2006; Guan & Yam, 2015; Tan & Tan, 2017).

The effort to change firm objectives, redistribute property rights, rebuild governance structures, and restore managerial incentives has been taken in parallel with economic reform that has installed market competition and spurred firm innovation. Table 2 summarizes the changes brought about by SOE restructuring in China and the implications for innovation. We propose the following baseline hypothesis:

Baseline Hypothesis: On average, SOE restructuring has a positive impact on innovative performance.

**Table 2** Adaptive changes in organizational restructuring and implications for firm innovation

Adaptive changes	Before restructuring	After restructuring	Implications for firm innovation
Organization objectives	Political, social, and economic objectives: SOEs provided political propaganda, social welfare (e.g., housing, healthcare, and retirement), and economic output	Predominantly economic objectives that emphasize economic output quality and efficiency, competitive advantage, and firm growth	Firms strategically prioritize innovations to achieve superior competitiveness
Property rights	Fully state-owned: All enterprise property rights were under state control	Dispersed state ownership: SOE privatization led to SOEs with privately held shares, joint ventures, and publicly listed firms	Privatization facilitates firm alignment with capitalistic market institutions that impose demands on firm innovation
Governance structure	Socioeconomic conglomerates under central planning: SOEs performed economic and social functions under full state control	Quasi-decentralized corporations under hybrid governance: all firms obtained functional independence with production specialization; subsidiaries were subject to parent firm approval; parent firms were advised by both director boards and state administration	Targeted technological development and optimized internal resource utilization can facilitate firm innovation
Managerial incentives	Politically entangled: SOE managers followed state commands and were promoted through the cadre system; managers were incentivized to prioritize administrative functions and take conservative actions to preserve their "iron bowls"	Predominantly firm-level managerial autonomy: managers are responsible for and evaluated by firm performance; managers are incentivized to take reasonable risks to increase firm profitability	Firm managers take risks in R&D investments to enhance production efficiency and product quality (e.g., R&D facility construction, adoption of new technology, skilled labor training)

Distinguishing State Ownership from State Affiliation: Dissonance-Based Impacts

Restructuring has entailed organizational changes intended to spur technological innovation, however, institutional logic dissonance may cause firms to fall short in implementing them (Pache & Santos, 2010; Oliver, 1991). Under state capitalism, the state exerts influence on restructured firms. Prior studies using the resource-based view show that state ownership and state affiliation are like a double-edged sword in terms of innovation performance (e.g., Li et al., 2018; Tan et al., 2007; Zhou et al., 2017). The two differ in that in the case of state ownership pressure is exerted on a restructured firm internally while in the case of state affiliation there is external pressure. Scholars taking an institutional perspective argue that the distinction is important as it affects the way a firm will respond to conflicting demands (Pache & Santos, 2010).

From an institutional perspective, the difference between state ownership and state affiliation lies in its impact on dissonance, and hence on innovative

performance. We extend the institutional framework on dissonance and change implementation (e.g., Pache & Santos, 2010, 2013; Oliver, 1991) to contrast the dissonance-based impacts of state ownership and state affiliation. Drawing on the institutional logic literature, we uncover the mechanisms by which state ownership and state affiliation moderate the *nature of demand conflicts* and the *internal representation of demands* (Pache & Santos, 2010). We explain why being state owned as opposed to state affiliated affects improvements in innovative performance after restructuring.

State ownership

Central planning and free market forces prescribe opposing organizational *goals* and legitimize different *means* by which they might be pursued (DiMaggio & Powell, 1983; Oliver, 1991; Pache & Santos, 2010). Economic reform in China has been aimed at developing the ability of firms to innovate. With SOE restructuring, the Chinese government, representing hierarchy institutions, has required firms to build "home-grown technologies". At the same



time, responding to the demands of the market, restructured firms have followed predominantly economic objectives such as profitability, competitive advantage, and growth. In theory, these goals are compatible, but this is not always the case in practice.

Some hierarchy-based norms and cultures have lingered, and this means that managers and employees of restructured firms sometimes behave in ways that should have been left behind, falling back on the old ways of doing things rather than adopting newly prescribed ways, or avoiding altogether what they perceive to be risky (Chen & Miller, 2010). Even after a firm has been restructured, the government continues to appoint top executives (Harrison, Meyer, Wang, Zhao, & Zhao, 2019; Buckley et al., 2018; Ralston et al., 2006). Executives who owe their positions to the government may prioritize political, or possibly social, objectives over economic ones, and even might reinstate traditional incentives. Consequently, restructured firms that are state-owned show greater resistance to market-based changes, and this limits the positive impact of restructuration on innovation.

Central planning and market institutions have different means by which to develop innovation. Although in China the role of central planning has declined since economic reforms, state-owned firms still have privileged access to resources and enjoy government protection (Tan et al., 2007; Liang et al., 2015; Zhou et al., 2017). They are likely to be dependent on resources allocated to them by the state, but not necessarily efficient in utilizing them (Li et al., 2018; Zhou et al., 2017). In contrast, the free market system rewards organizational efficiency and technological innovation, pushing firms to innovate through “creative destruction” (Schumpeter, 1942).

Conflicts over institutional means are a salient feature of state-owned firms. In addition to having privileged resource access, managers are protected from competition, since the central government is the majority shareholder (Harrison et al., 2019; Liang et al., 2015; Ralston et al., 2006). This engenders a degree of complacency that undermines the desire of managers to undertake innovation. Thus, state-owned firms, although restructured, are lagging in innovative performance.

Hypothesis 1: State ownership reduces the positive impact of restructuration on firm innovative performance.

State affiliation

We have referred repeatedly to state-owned and state-affiliated firms. In China, when the central government continues to be involved in the administration of a restructured firm, that firm is said to have state affiliation status, or simply to be state affiliated (Tan et al., 2007; Li et al., 2018). There is an important difference between this kind of government–firm link and other forms of government–business collaboration such as public–private partnership. A focal firm has little autonomy in determining its affiliation status as that is granted by the central government. The government developed a government–business hierarchical system, termed *li-shu*, as part of the SOE restructuration program.

Under that system, the central government and local administrations (provincial, municipal, county and township) established administrative affiliations with firms (Tan et al., 2007). The *li-shu* system is a crucial part of the quasi-decentralized public governance system (Hassard et al., 2010; Buckley et al., 2018). Firms deemed by the central government to be performing a strategically important role in furthering the national economic development agenda are assigned state affiliation status and are positioned at the top level, with lower-tier firms placed under them. The central government directly advises and monitors the functional operations of state-affiliated firms, and state-affiliated firms monitor non-state-affiliated ones (Li et al., 2018; Tan et al., 2007).

Unlike as in the case of state ownership, the central government has an arms-length role in the governance of state-affiliated firm (Tan et al., 2007). The central government nominates external board members and advisors (Hassard et al., 2010). While those named do represent the state and convey its interests, they are nonetheless external institutional actors. This means that they have less exposure to the internal norms and culture of the firm and so are less likely to conform to its hierarchy-based logic. On the contrary, they are likely to emphasize economic objectives as the firms to which they are assigned are in sectors that are strategically important (Hassard et al., 2010; Tan et al., 2007). Their role is to monitor internal practices so as to increase firm efficiency (Megginson & Netter, 2001; Jensen & Meckling, 1976).

State-affiliated firms make strategic decisions autonomously, including executive appointments and internal promotions (Buckley et al., 2018; Hassard et al., 2010). Restructured firms have



fiduciary duties vis-à-vis their private shareholders, who themselves can influence firm policy, for example they might join forces to see that managers are appointed and promoted based on criteria like firm performance (Hassard et al., 2010). State affiliation facilitates the implementation of market-based organizational changes, such as the adoption of performance-driven objectives and managerial incentives. Consequently, we expect state-affiliation to boost innovative performance.

State-affiliated firms focus on technologies that the state deems to be of top priority. State affiliation provides an entrée for participation in inter-organizational efforts to develop innovation competence. For instance, state-affiliated firms collaborate with government-funded research-intensive universities in innovation networks that focus on strategically important technologies (Li et al., 2018). Such collaboration provides R&D managers an opportunity to work with academics and scientists on the development of cutting-edge technologies, thus reducing the risks inherent in developing them entirely within the firm.

Foreign firms with technological expertise, when strategizing Chinese market entry, often find it preferable to establish joint ventures (JVs) with state-affiliated firms rather than state-owned ones. Cross-border JVs provide opportunities to develop innovative competences needed for “home-grown” technologies (Guan & Yam, 2015). State-affiliated firms can also benefit from exposure to market-based practices of foreign firms. Domestically, state affiliation enhances legitimacy (Xu, Lu, & Gu, 2014). Like foreign firms, domestic private firms prefer joint venturing with state-affiliated firms. Just as cross-border partnerships help state-affiliated firms enter foreign markets, domestic public-private partnerships can increase their domestic market share (Harrison et al., 2019; Liang et al., 2015). Thus, both cross-border and domestic JVs are opportunities for state-affiliated firms to participate in the market economy and thereby develop their innovations.

Hypothesis 2: State affiliation strengthens the positive impact of restructuring on firm innovative performance.

Interactions between state ownership and state affiliation

State ownership and state affiliation are not mutually exclusive. Indeed, some firms are both state owned and state affiliated. The central government

uses different criteria to decide the level of equity it wants to take in a firm and whether or not it will be state affiliated. For instance, the central government may determine that majority ownership of a particular SOE is the best way to optimize use of organizational resources or may decide that privatization is the best way to do that. Thus, private shareholders have a majority share in some SOEs and the state has a majority share in others, for example those deemed to be of strategic importance.

As we touched on earlier, the central government may nominate an external advisory committee, i.e., made of members not involved in SOE internal governance, to monitor at arms-length state-affiliated firms deemed of importance to its national economic development agenda. The state exerts its influence over state-affiliated firms internally through managers it names to run the firm and externally through independent board members and advisors. While their roles are quite distinct, because they are all central government appointees it is likely that they will forge strong interpersonal bonds, almost inevitably blurring the line between internal and external state influence.

Firms that are concurrently state-owned and state-affiliated are subject to both political and economic constraints. For instance, SOE managers might prioritize maintaining the organizational *status quo*, whereas external state representatives might push for organizational change to improve production efficiency. On the other hand, dual state connections allow state-affiliated firms to access resources and expertise from central planning and from the market. From a resource-based perspective, both state ownership and state affiliation are likely to increase innovation (Jia et al., 2019; Li et al., 2018; Tan et al., 2007; Zhou et al., 2017). However, from an institutional perspective, state ownership erodes firm legitimacy in the eyes of private sector stakeholders (Li et al., 2018). In other words, firms that are both state-owned and state-affiliated are subject to state influence of two types, internal and external, and which dominates determines the impact of state influence on innovation.

If hierarchy-based institutional logic prevails, the result can be resource misallocation and decreased efficiency (Huang & Snell, 2003). For example, external board members and advisory committee members may support one another in prioritizing firm investment in domestic innovation even when it reduces firm efficiency, or be reluctant to oppose

a colleague proposing the allocation of resources to protect employment at the expense of efficiency. Central planning reduces a firm’s independence and breeds managerial complacency, which can erase the benefits of inter-organizational collaborations. Lacking incentives to increase efficiency, managers are unlikely to attempt to learn from their partners. Hence:

Hypothesis 3(a): State ownership weakens the positive impact of state affiliation on a firm’s innovative performance.

Market-based institutional logic may prevail at state-affiliated SOEs. State affiliation may offset the negative impact of state-ownership for two main reasons. First, the central government exerts pressure on their representatives to reduce inefficiency in state-affiliated firms and holds them accountable for firm performance (Ralston et al., 2006). Second, state-affiliated firms are also subject to scrutiny from private stakeholders and domestic and foreign market participants (Li et al., 2018) because of their cross-border collaborations and reverse market entry (Mariotti & Marzano, 2019; Liang et al., 2015). Hence:

Hypothesis 3(b): State affiliation reduces the negative impact of state ownership on innovative performance.

Figure 1 and Table 5 in “Appendix 1” summarize the argument.

DATA AND METHODOLOGY

Empirical Context: Chinese High-Speed Train Sector from 1989 to 2015

We test our hypotheses using data on firms in the Chinese high-speed train sector from 1989 to 2015.

The Chinese high-speed train sector is a good empirical context to test our hypotheses. The Chinese government has prioritized the development of indigenous technology in various manufacturing industries (Zhou et al., 2017), and especially in land transportation; the development of indigenous innovation in the high-speed train sector is a high priority, and the SOEs in this sector have been restructured to increase their innovative performance.

In this sector, SOE restructuring has proceeded under the Modern Enterprise System (MES) program, which establishes economically oriented enterprises within a semi-decentralized corporate governance structure (Hassard, Sheehan, Zhou, Terpstra-Tong, & Morris, 2007; Xu et al., 2014; Zhou et al., 2017). Manufacturing firms in the Chinese high-speed train sector belong to one of four groups: state-owned and state-affiliated, state-owned and non-state-affiliated, non-state-owned and state-affiliated, and non-state-owned and non-state-affiliated. They therefore experience a varying level of internal logic inconsistency (Pache & Santos, 2010). SOE restructuring in the high-speed train sector has occurred gradually over our study period (1989 to 2015). Consequently, our data has some longitudinal and cross-sectional variance. The central government has adopted two key policies to spur indigenous technological development: “encouraging technology transfer from multinationals (in return for market access) and a coordinated R&D-investment effort” (Orr & Roth, 2012, p. 5). In the high-speed train sector, SOEs often take the lion’s share of “coordinated R&D-investment” support in the form of state-backed bonds, state investments, and tax holidays.

Given concerns for national security and defense, foreign firms typically avoid transferring technology to state-owned firms, but are more willing to

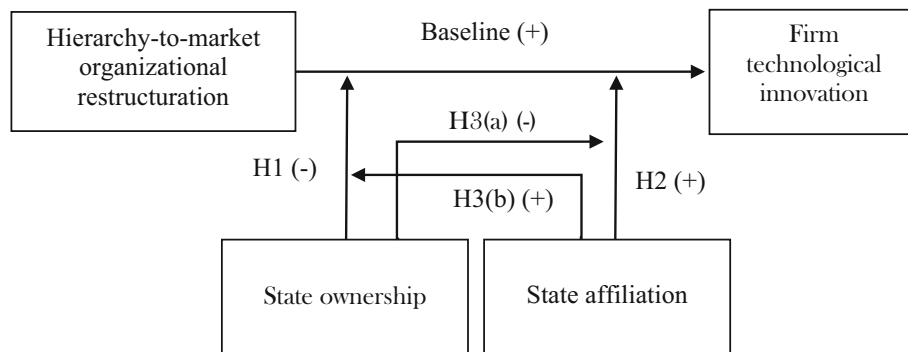


Figure 1 Contingency model of organizational restructuring, state influences, and firm technological innovation.



strike alliances with state-affiliated ones. State-affiliated firms have also complemented the knowledge accessed through cross-border technology transfers by collaborating on R&D with domestic private-sector firms and research institutions.

Data and Variables

We collected and combined primary data from corporate yearbooks, annual reports, district annals, and patent records from the Chinese State Intellectual Property Office (SIPO) for all manufacturing firms in the Chinese high-speed train sector. We triangulated our data sources on the firms' internal resources, restructuring program completion, connections with the state, and patent output. After eliminating missing records using the pairwise deletion method, we were left with an unbalanced panel dataset of 197 firms and 1856 firm-year observations.

Dependent variables

We measured innovation by yearly invention patent output (Liegalsz & Wagner, 2013; Zhou et al., 2017). In the Chinese high-speed train sector, restructuring programs have placed great emphasis on the development of indigenous technology (Sun, 2015). Hence, annual changes in a firm's invention patent output reflect its innovative performance due to restructuring. To be consistent with the literature, we used the firm-year count of *invention patent applications* (log-transformed) (e.g., Grigoriou & Rothaermel, 2017; Schilling, 2015; Sytch & Tatarynowicz, 2014). We triangulated our analysis with three additional measures of innovative performance: firm-year count of *invention patent publications* (log-transformed) (e.g., Wang, Rodan, Fruin, & Xu, 2014), *invention patent conversion ratio* (i.e., patent publication count divided by application count), and *R&D employee productivity* (i.e., number of patent applications divided by number of R&D employees). We transformed all count variables to logarithmic scales to correct for normality.

Independent variables

Our main independent variables are organizational restructuring, state ownership, and state affiliation. *Organizational restructuring* is measured by the number of years since the completion of the MES restructuring program at each firm, with the restructuring indicator equal to 1 for firm i in year t if the firm had formally reported MES restructuring completion (inclusive of the year in which the

MES program was completed), and 0 otherwise. The completion of the MES restructuring program is indicated in corporate yearbooks by formal records on economic production specialization, firm ownership and voting right redistribution, the establishment of a "Western-like" corporate governance structure, and a statement indicating that the firm's strategic objective is to "develop indigenous technology".

State ownership is an ordinal variable equal to 0 for publicly listed firms, 1 for public-private joint ventures (i.e., including purely domestic and international ones), and 2 for restructured SOEs (i.e., SOEs before restructuring completion and firms with majority state ownership after restructuring). Since we are interested in how state ownership moderates the impact of restructuring on innovation, we looked at the level of state ownership after the completion of restructuring.

The indicator for *state affiliation* is a binary variable. Following Tan et al. (2007) and Li et al. (2018), it equals 1 for each restructured firm with direct administrative affiliation with the central government and zero otherwise. In the Chinese high-speed train sector, non-state-affiliated firms function as subsidiaries of state-affiliated ones. The central government's reform agenda has identified strategically important sectors as "top-priority" and given direct affiliation to the restructured firms in those sectors. State affiliation is exogenous to the firm since it is determined by the central government. A firm cannot change it without going through significant corporate re-organization approved by the central government. In this study, firms have generally maintained state affiliation since restructuring.

Control variables

In addition to R&D efficiency, financial and human resources are critical for firm innovation (e.g., Bloom, Romer, Terry, & Van Reenen, 2013; Zhou et al., 2017). Hence, we controlled for firm revenues, profits, total number of employees, and total number of R&D employees.

Estimation Model

We used the generalized least squares (GLS) estimator with firm-level clustered standard errors because of the presence of heteroscedasticity and serial correlations in the data (Ryan, 2008). We used a random-effect specification in which the error terms captures unobserved factors at the firm-year level. We also included industry-fixed effects to

Table 3 Summary statistics and pairwise correlations

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Invention patent application count (log transformed)	1.000										
2. Invention patent publication count (log transformed)	0.910	1.000									
3. Invention patent conversion ration	0.740	0.820	1.000								
4. R&D employee productivity	0.790	0.830	0.730	1.000							
5. Organizational restructuring	0.320	0.310	0.270	0.320	1.000						
6. State affiliation	0.150	0.130	0.110	0.150	- 0.330	1.000					
7. State ownership	- 0.100	- 0.100	- 0.080	- 0.080	- 0.300	0.320	1.000				
8. Firm revenue (log transformed)	0.460	0.440	0.370	0.400	0.190	0.480	- 0.050	1.000			
9. Firm profit (log transformed)	0.490	0.470	0.380	0.430	0.360	0.250	- 0.210	0.740	1.000		
10. Firm size (log transformed)	0.170	0.160	0.110	0.090	- 0.320	0.660	0.150	0.610	0.340	1.000	
11. R&D employee count (log transformed)	0.230	0.210	0.160	0.110	- 0.240	0.540	- 0.010	0.600	0.420	0.880	1.000
Mean	0.392	0.342	4.688	0.109	0.489	0.553	1.820	9.965	6.514	7.274	5.166
S.D.	0.975	0.911	0.234	0.230	0.500	0.497	0.438	1.974	2.309	1.805	1.779
Min	0.000	0.000	4.605	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max	5.273	5.236	6.397	2.335	1.000	1.000	2.000	16.310	13.540	12.540	10.270

N = 1856; all tests are two-tailed; pairwise correlations with an absolute value greater than 0.04 are statistically significant at the level of $p \leq 0.01$.

account for industry-specific, time-invariant errors, as well as year-fixed effects. The following equation specifies our main analytical model:

$$\ln(1 + \text{patent application count})_{it} = \beta_0 + \beta_1 \text{restructuring}_{it} + \beta_2 \text{ownership} \times \text{restructuring}_{it} + \beta_3 \text{affiliation} \times \text{restructuring}_{it} + \beta_4 \text{ownership} \times \text{affiliation} \times \text{restructuring}_{it} + BX_{it} + u_{it} + \alpha_j + \delta_t,$$

where X_{it} is the vector of control variables, u_{it} is the random error term, and α_j and δ_t are the industry- and year-fixed errors.

RESULTS

Table 3 reports the descriptive statistics and pairwise correlation matrix. The variance inflation factor (VIF) values for our full model are below 7.74, with an average of 3.71, which is below the commonly accepted value of 10 (e.g., Elango &

Pattnaik, 2007; Griffith & Harvey, 2001). Table 4 reports the results from the GLS panel regression models. Model 1 includes control variables and error terms only. In Model 2, we add the organizational restructuring indicator to test our baseline hypothesis. In Model 3, we add the interaction term between state ownership and organizational restructuring to test Hypothesis 1. In Model 4, we add the interaction term between state affiliation and restructuring to test Hypothesis 2. In Model 5, we add the interaction term between state ownership and state affiliation. Model 6 includes a three-way interaction between affiliation, ownership, and restructuring to test Hypothesis 3 and to validate the predictions of the other hypotheses.

In Model 2, the coefficient estimate of organizational restructuring is positive and statistically significant ($\beta = 0.371, p = 0.001$), which indicates that restructuring raises firm-year invention patent applications by 45%. In Model 6, the coefficient estimate of organizational restructuring is positive and statistically significant ($\beta = 1.385, p = 0.011$), which indicates a three-fold

**Table 4** Determinants of firm innovation in the Chinese high-speed rail sector

Independent and control variables	Dependent variable: invention patent application counts (log transformed)					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Firm revenue	0.0724 (0.0541) <i>(0.181)</i>	0.0774 (0.0540) <i>(0.152)</i>	0.0740 (0.0525) <i>(0.159)</i>	0.110 (0.0509) <i>(0.031)</i>	0.0802 (0.0537) <i>(0.135)</i>	0.105 (0.0481) <i>(0.029)</i>
Firm profit	0.0333 (0.0205) <i>(0.105)</i>	0.0270 (0.0204) <i>(0.186)</i>	0.0267 (0.0202) <i>(0.186)</i>	0.00333 (0.0198) <i>(0.866)</i>	0.0262 (0.0204) <i>(0.198)</i>	0.00294 (0.0197) <i>(0.881)</i>
Firm size	0.0965 (0.0551) <i>(0.080)</i>	0.108 (0.0543) <i>(0.046)</i>	0.111 (0.0544) <i>(0.041)</i>	0.106 (0.0547) <i>(0.054)</i>	0.105 (0.0553) <i>(0.059)</i>	0.107 (0.0552) <i>(0.053)</i>
R&D employees	0.0935 (0.0394) <i>(0.018)</i>	0.0920 (0.0400) <i>(0.021)</i>	0.0889 (0.0397) <i>(0.025)</i>	0.128 (0.0401) <i>(0.001)</i>	0.0980 (0.0402) <i>(0.015)</i>	0.131 (0.0401) <i>(0.001)</i>
State affiliation	0.0925 (0.159) <i>(0.561)</i>	0.139 (0.164) <i>(0.397)</i>	0.150 (0.160) <i>(0.348)</i>	− 0.542 (0.168) <i>(0.001)</i>	1.412 (0.522) <i>(0.007)</i>	1.687 (0.562) <i>(0.003)</i>
State ownership	0.518 (0.208) <i>(0.013)</i>	0.543 (0.206) <i>(0.008)</i>	0.702 (0.284) <i>(0.014)</i>	0.319 (0.161) <i>(0.047)</i>	0.664 (0.248) <i>(0.007)</i>	1.169 (0.248) <i>(0.000)</i>
Organizational restructuring		0.371 (0.108) <i>(0.001)</i>	0.742 (0.522) <i>(0.155)</i>	− 0.282 (0.118) <i>(0.017)</i>	0.369 (0.108) <i>(0.001)</i>	1.385 (0.545) <i>(0.011)</i>
State ownership × restructuring			− 0.197 (0.272) <i>(0.469)</i>			− 0.890 (0.281) <i>(0.002)</i>
State affiliation × restructuring				1.049 (0.191) <i>(0.000)</i>		− 0.723 (0.779) <i>(0.353)</i>
State affiliation × state ownership					− 0.668 (0.260) <i>(0.010)</i>	− 1.158 (0.263) <i>(0.000)</i>
State affiliation × state ownership × restructuring						0.947 (0.413) <i>(0.022)</i>
Constant	− 2.569 (0.383) <i>(0.000)</i>	− 2.731 (0.381) <i>(0.000)</i>	− 3.022 (0.577) <i>(0.000)</i>	− 2.120 (0.333) <i>(0.000)</i>	− 2.934 (0.423) <i>(0.000)</i>	− 3.686 (0.511) <i>(0.000)</i>
Observation	1856	1856	1856	1856	1856	1856
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Firm-clustered robust standard errors in parentheses; p values in italics and in parentheses.

(i.e., 300%) increase in innovative performance attributed to restructuring. Baseline Hypothesis predicts a positive relationship between organizational restructuring and firm innovation. The results here support the prediction of Baseline Hypothesis.

In Model 3, the coefficient estimate of the interaction term between state ownership and organizational restructuring is negative but not significant ($\beta = -0.197$, $p = 0.469$). In Model 6, the coefficient estimate of the interaction term

between state ownership and organizational restructuring is negative and statistically significant ($\beta = -0.890$, $p = 0.002$). We interpret this coefficient in combination with that of the organizational restructuring ($\beta = 1.385$, $p = 0.011$) for the magnitude of the interaction effect. For state-owned firms, restructuring improves innovative performance by 64%, compared to 300% improvement for non-state-owned firms. Hypothesis 1 predicts a negative moderation effect from state ownership on Baseline Hypothesis. Model 6

supports the prediction of Hypothesis 1, but Model 3 does not support this prediction.

In Model 4, the coefficient estimate of the interaction term between state affiliation and organizational restructuring is positive and statistically significant ($\beta = 1.049$, $p = 0.000$). Model 4 also yields a negative and significant coefficient estimate of organizational restructuring ($\beta = -0.282$, $p = 0.017$). That is, restructuring improves innovative performance by 115% for state-affiliated firms, compared to a 25% reduction in innovation for non-state-affiliated firms. In Model 6, the coefficient estimate of the interaction term between state affiliation and organizational restructuring is negative but not significant ($\beta = -0.723$, $p = 0.353$). Hypothesis 2 predicts a positive moderation effect from state affiliation on Baseline Hypothesis. Model 4 supports the prediction of Hypothesis 2, but Model 6 does not support this prediction.

In Model 6, the coefficient estimate of the three-way interaction term (i.e., interaction between state ownership, state affiliation, and organizational restructuring) is positive and statistically significant ($\beta = 0.947$, $p = 0.022$). As previously noted, Model 6 also yields statistically significant coefficients of restructuring ($\beta = 1.385$, $p = 0.011$) and its interaction with state ownership ($\beta = -0.890$, $p = 0.002$), but that of the interaction between restructuring and state affiliation is not statistically significant ($\beta = -0.723$, $p = 0.353$). These coefficients indicate that, for a firm that is both state-owned and state-affiliated, restructuring raises innovative performance by 323%, compared to 64% innovation increase for a firm that is state-owned but not affiliated. Hypothesis 3(b) predicts a positive moderation effect from state affiliation on Hypothesis 1, whereas Hypothesis 3(a) predicts a negative moderation effect from state ownership on Hypothesis 2. Model 6 thus yields evidence for Hypothesis 3(b).

To probe the three-way interaction visually, we graph the results of Model 6 in Fig. 2. The slopes describe the average increase in innovation performance after restructuring for each group of firms: those with high state ownership and state affiliation (Group 1); those with high state ownership but no state affiliation (Group 2); those with low state ownership and state affiliation (Group 3); and those with low state ownership and no state affiliation (Group 4). There is no statistical difference between the slopes for Group 1 and 3, meaning that restructuring was equally effective for state-

affiliated firms that are state-owned or predominantly privatized. This suggests that state ownership has a weaker impact on innovation than state affiliation. In contrast, the slope for Group 1 is significantly steeper than that for Group 2, meaning that restructuring is more effective for state-owned firms that are state-affiliated than for those that are state-owned but not state-affiliated. This suggests that state affiliation has a greater impact on innovation than state ownership. Model 6 thus provides support for Hypothesis 3(b) but not for Hypothesis 3(a).

Moreover, the slope of Group 4 is significantly steeper than that of Group 2, but similar to those of Groups 1 and 3. This suggests that restructuring is more effective in predominantly privatized firms without state affiliation than it is in state-owned firms without affiliation; yet, it is similar to that of state-affiliated firms with or without majority state ownership. These results indicate that the impact of state affiliation has been mainly in the restructured firms that have remained state-owned. We infer that, at least in our sample, a high degree of privatization would have established a stronger market-based logic in the restructured firms.

Post Hoc Analysis

We discuss inferences from the coefficients of the interaction term between state ownership and affiliation. Although we have not hypothesized this interaction effect, it is worthwhile to consider potential complementarity or substitution between the two forms of state governance. In both Model 5 and Model 6, the coefficient estimate of the interaction term between state ownership and state affiliation is negative and statistically significant ($\beta = -0.668$, $p = 0.010$; $\beta = -1.158$, $p = 0.000$). This suggests that state ownership and state affiliation are substitutes regarding their effect on firm innovation.

In our empirical context, state-owned firms primarily relied on their own R&D, and state-affiliated firms on collaboration with external research organizations. Chinese firm R&D has mostly taken the form of imitation by reverse engineering (e.g., Hu, Jefferson, & Qian, 2005), while innovation based on public-private collaboration is more exploratory and more likely to incorporate scientific discoveries (e.g., Tan & Tan, 2017). The substitutive effect of state ownership and state affiliation suggests that the concurrent use of exploitation and exploration may not generate synergy (March, 1991) because innovation efforts may suffer from unclear R&D

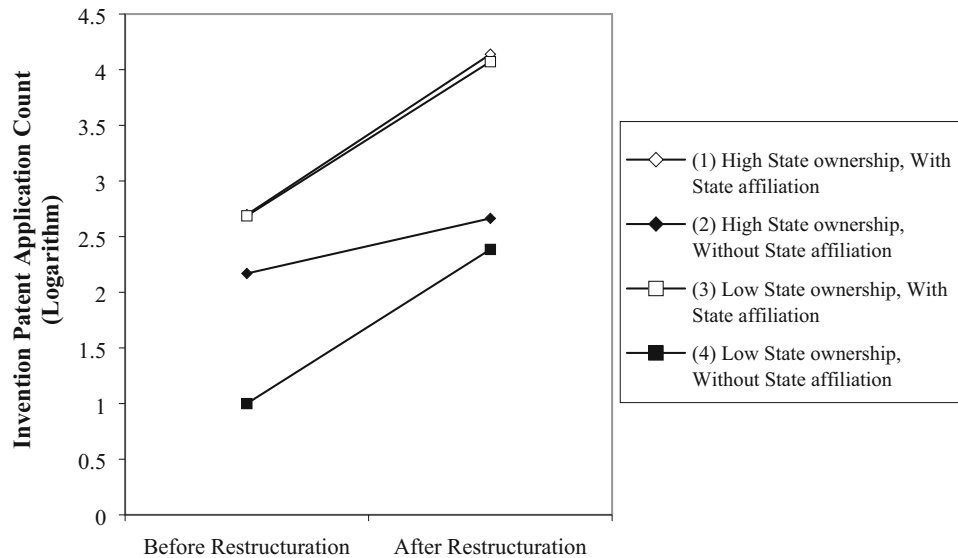


Figure 2 Three-way interaction between organizational restructuring, state ownership, and state affiliation on firm-year invention patent application counts (logarithm).

direction. In other words, we infer from the substitutive effect of state ownership and state affiliation that the two main mechanisms for knowledge acquisition, technology transfer by foreign firms and domestic R&D, are substitutes rather than complements.

DISCUSSION

Generalizable Insights and Theoretical Contributions

In this study, we distinguish between state ownership and state affiliation, and using an institutional logic perspective, we analyze the double-edged effect of the state on technological innovation. We find that in the Chinese high-speed train sector state ownership reduces the impact of restructuring on SOE innovation, but that state affiliation has the reverse effect. When both state ownership and state affiliation are present, state affiliation dominates and compensates for the negative impact of state ownership.

Our results make the following contributions to the international business literature. First, we contribute to the growing research on technological innovation in emerging economies (e.g., Bhagavatula, Mudambi, & Murmann, 2019; Krishnan & Prashantham, 2019; Li et al., 2018; Mudambi, 2011; Zhou et al., 2017). Our findings explain how different types of state influence lead to different innovation outcomes following SOE

restructuring. Scholars generally agree that the restructuring of SOEs along free market lines is conducive to innovation (Zhou et al., 2006). However, because post-reform emerging economies are characterized by a mix of capitalism and socialism, firms are subject to conflicting institutional demands (Mariotti & Marzano, 2019; Hu et al., 2019), casting doubt on whether government involvement always fosters firm innovation (Krishnan & Prashantham, 2019; Zhou et al., 2017). Building on seminal studies of institutional logic and organizational change under institutional pluralism (Oliver, 1991; Pache & Santos, 2010; Meyer & Peng, 2016; Zhou et al., 2017), we distinguish between the impact of government ownership and that of government affiliation on the performance of SOEs after restructuring.

Second, we contribute to the body of research on state governance, organizational change, and institutional logic in emerging economies (Buckley et al., 2018; Ramamurti & Hillemann, 2018; Zhou et al., 2006). We extend the institutional logic framework of demand conflicts and organizational change implementation (Pache & Santos, 2010, 2013; Oliver, 1991) to disentangle the impact of state ownership from that of state affiliation on the outcome of market-based restructuring.

Third, our analysis contributes to the institution-based theory of the firm in emerging economies (Meyer & Peng, 2016). We describe the conflicts between capitalist market forces and socialist



hierarchy in regulatory regimes, normative orders, and cultural logic in post-reform China—an emerging economy under state capitalism (Hu et al., 2019; Mariotti & Marzano, 2019). We summarize key changes in the restructuring of SOEs and develop their implications for innovative performance. We show how internal and external state intervention exerts distinct influences on a firm. Our findings extend current institutional perspectives on state governance and firm advantages in innovation-driven industries (Jia et al., 2019; Liang et al., 2015; Zhou et al., 2017).

Generalizability to China

The conceptual and empirical distinctions between state ownership and state affiliation contribute to a more thorough understanding of the nature of state influence on Chinese firms (Buckley et al., 2018). Our findings point to several distinctively Chinese firm advantages, including government-created and leapfrogging advantages in sunrise industries (Ramamurti & Hillemann, 2018). We illustrate how affiliation-based and ownership-based state influences generate advantages and disadvantages for firm innovation.

We find that technological late movers in China may be able to leapfrog only if the government support they receive is consistent with their institutional logic and the external institutional environment. For example, several major Chinese SOEs that have recently attempted to export their high-speed rail expertise to other developing countries have encountered serious obstacles. Among others, one factor is the differences between China and target countries in their institutions and economic strengths. Therefore, the institutional environments in these export destinations are inconsistent with the Chinese SOEs' institutional means of achieving firm advantages through government-created resource endowment. It is thus important for Chinese firms to leverage state support that is consistent with the institutional environment in which they operate.

Generalizability to other emerging economies

The governments of other emerging economies are also seeking to increase firm innovation (Bhagavatula et al., 2019; Krishnan & Prashantham, 2019). Our findings on the double-edged impact of state influence may be applicable to them. India, for instance, has undergone a major institutional transition since its reforms in 1991. There is now an Indian innovation ecosystem of public agencies,

government-owned entities, multinational enterprises, and domestic private firms (Bhagavatula et al., 2019; Krishnan & Prashantham, 2019).

Nonetheless, post-reform government involvement has not been an unqualified success. Public financing and other support for scientific research projects and for industry–academia collaborative efforts have been instrumental to the creation of that ecosystem, but cumbersome regulations and ambivalent policies have hindered the growth of some high-technology industries (Krishnan & Prashantham, 2019). State governments in other emerging economies may consider applicable lessons from the Chinese context to modify public–private partnerships for technological innovation development.

Practical Implications

Developing countries contribute significantly to the global economy. As their economic expansion continues, their policymakers and business leaders increasingly emphasize the need for domestic technological innovation. Our findings show that SOE restructuring can result in more innovation, but the effectiveness of restructuring hinges on whether the state exerts its influence through government ownership or administrative affiliation. We find that government ownership lowers the benefits of SOE restructuring, dampening innovation. In contrast, arms-length governance by the state through administrative affiliation offsets the negative impact of state ownership on the benefits of restructuring and spurs technological innovation.

These results highlight both opportunities and challenges for firm managers involved in developing technological innovation in emerging countries. They suggest that governmental involvement can be a double-edged sword, when at arms-length, it can bolster innovation, but extensive involvement by the government in internal governance does not. This insight is applicable not only to restructured SOEs but also to private firms in emerging economies. Our analysis highlights how state-endorsed inter-organizational collaborations, including cross-border ones, can enhance domestic technological development. As Jack Ma, the former CEO of Alibaba, expressed succinctly and humorously at an event organized by the Wall Street Journal, when it comes to Chinese government–firm relationships: “Always be in love with them, but don’t marry them.”



Limitations and Future Research

Walsh and Kosnik (1993, p. 692) note: “One of the hallmarks of provocative research is that it generates more questions for continued research than it answers.” While we believe we have contributed to the quest for answers, and hope that what we have done will inspire future research, we acknowledge limitations of our study which are common in exploratory research. First, we do not take into account the impact on innovation of SOE-specific internal changes implemented during their restructuring. There might have been differences across SOEs in terms of planning and organizing research activities and in type and level of R&D investment. Moreover, we look only at what happens to innovation after restructuring is completed. Our results therefore only reflect the average effect of changes commonly adopted by the restructured firms in our sample. Future research may benefit from a finer-grained approach to identify what aspects of SOE restructuring have been effective in spurring technological innovation.

Second, we have not accounted for firm-specific technological targets in our measure of firm innovative performance. When China undertook restructuring each firm was assigned to a particular industry and to its associated technologies. Accordingly, state-owned and state-affiliated firms were asked to pursue the technological targets specified in the central government’s sector-wide reform plans. Some firms were asked to develop innovative capabilities for export (e.g., rail car functionality) and others for domestic use (e.g., car-track signaling integration). We do not take into account that state-owned firms have principally been active in the export market with the Chinese government negotiating the majority of international contracts, while state-affiliated firms have often prioritized the development of indigenous technologies for domestic use.

Without details on firm-specific technological targets, our research design means that we inevitably missed an opportunity to shed light on the implications of a firm’s technological development trajectories under different state influences. For example, while state-owned and state-affiliated firms must fulfill state-requested innovation goals, *bona fide* private firms are free to select their technological targets. Relatedly, privatized SOEs and *bona fide* private firms in emerging economies are under the influence of different stakeholders who may interact with political stakeholders

differently, and this may affect their technological trajectories. Future research could investigate whether *bona fide* private firms and privatized SOEs differ in their innovation trajectories, and in particular in their technological specialization.

Third, we did not hypothesize on whether there is an interaction effect of state ownership and state affiliation on firm inventions, although we included this two-way interaction when testing Hypothesis 3. We found a negative and significant effect from this interaction in both Model 5 and in the full model (Model 6). We inferred from the negative and significant coefficients of the interaction term in both models that different external knowledge acquisition mechanisms – cross-border technology transfer, predominantly associated with state ownership, and public–private research collaboration, generally associated with state affiliation – were likely substitutes. While these inferences are preliminary, they suggest that future research might tease out the conditions under which state ownership and state affiliation act as complements for the development of technological innovation, and when they are substitutes. This could be done using a resource, knowledge, or institution-based perspective.

Future research might also focus on the institutional conflicts that may arise in SOEs from simultaneous state ownership and state affiliation. Without adequate information on how managers and board members interact, we do not know whether hierarchy or market logic will prevail. In our research context, we empirically observe that state affiliation can compensate for the negative effect of state ownership, which suggests that market logic prevails. However, we cannot rule out the possibility that government representatives may prioritize personal political advancement over economic performance and collude with SOE managers. Future studies may aim to throw light on this.

Finally, we measured firm innovation by its yearly output of invention patents. Patents are only precursors to the development and marketing of new products. They do not capture how well the firm can carry out the commercialization of its inventions (Zhou et al., 2017). Product commercialization tends to be more resource-intensive than its invention. We chose to focus on inventions to show how an approach based on institutional logic complements one based on the resource-based view (e.g., Li et al., 2018; Zhou et al., 2017). Future studies might combine this



approach and institutional theory to look at firm capabilities in both technological invention and product commercialization and thus provide insights on the entire value creation process (Oliver, 1997).

CONCLUDING REMARKS

We provide insights on the role the state can play in fostering innovation by looking at an industry in which China has leapfrogged into a leadership position. Chinese firms, whether private or state owned, have become increasingly integrated into global value chains as customers and suppliers. Scholars, policymakers, and practitioners alike need to know more about them. Although our study focuses on China, our findings may be applicable to other emerging economies, such as India, which have pushed for the development of technological capabilities and stressed joint efforts between the public and private sectors. While it is too early to draw definitive conclusions, we hope our effort will encourage further research on this important topic.

ACKNOWLEDGEMENTS

This research is in part supported by Grants from Social Science and Humanities Research Council of Canada and National Natural Science Foundation of China (71472131, 71732005, and 71401183).

NOTES

¹We report and discuss the results from the main analysis using firm-year invention patent applications. Results using patent publications, conversion ratio, and R&D employee productivity are consistent with the main results, and we show them in “Appendix 2”.

REFERENCES

- Aftab, S., & Shaikh, A. S. 2013. Reforming state-owned enterprises. *Pakistan policy note*. no. 4 ed. Washington D.C.: World Bank.
- Bhagavatula, S., Mudambi, R., & Murmann, J. P. 2019. Innovation and entrepreneurship in India: An overview. *Management and Organization Review*, 15(3): 467–493.
- Bin, G. 2008. Technology acquisition channels and industry performance: An industry-level analysis of Chinese large- and medium-size manufacturing enterprises. *Research Policy*, 37(2): 194–209.
- Bloom, N., Romer, P. M., Terry, S. J., & Van Reenen, J. 2013. A trapped-factors model of innovation. *American Economic Review*, 103(3): 208–213.
- Bruton, G. D., Peng, M. W., Ahlstrom, D., Stan, C., & Xu, K. 2015. State-owned enterprises around the world as hybrid

²We preserved the firm-year observations of zero patent output to mitigate sample selection bias. For example, we calculated $\ln(1 + \text{patent application count})$ to be the dependent variable in the main analysis.

³Our firm sample consists of 197 firms, and 195 firms have maintained the same state affiliation status since SOE restructuring program took effect at the firms. The two exceptions underwent state-directed secondary organizational restructuring and received status upgrade to state-affiliated in 2008 and 2010, respectively.

⁴All control variables are log-transformed to improve model estimation efficiency.

⁵The control variable vector also includes state ownership, state affiliation, and ownership X affiliation as components of the full factorial.

⁶Although we did not hypothesize this interaction effect, it is included as a part of the full factorial because we have no theoretical reason to exclude it. We report the coefficient estimates for the interaction between state ownership and state affiliation in Model 5 and Model 6 and discuss the interpretations in our Post Hoc Analysis.

⁷From a theoretical standpoint, acquiring external knowledge from different sources can either produce synergies via knowledge recombination or create incompatibility and confusion (Burt, 1992). Whether different knowledge acquisition mechanisms are substitutes or complements is an empirical question. The finding here is in agreement with Bin (2008), which reported that in the Chinese manufacturing industries foreign technology transfer tends to substitute for inter-industry R&D spillover and domestic technology transfer.

⁸Wall Street Journal. [YouTube]. (2014, October 29). Alibaba’s Jack Ma on the government in China. [Video file]. Retrieved from https://www.youtube.com/watch?v=KNWlyr7_gKs.

⁹China’s central government mediates major technological export contracts in the high-speed train sector as part of the “Belt and Road” initiative.



- organizations. *Academy of Management Perspectives*, 29(1): 92–114.
- Buckley, P. J., Clegg, L. J., Voss, H., Cross, A. R., Liu, X., & Zheng, P. 2018. A retrospective and agenda for future research on Chinese outward foreign direct investment. *Journal of International Business Studies*, 49(1): 4–23.
- Burt, R. 1992. *Structural holes: The social structure of competition*. Cambridge: Harvard University Press.
- Chang, H. J. 2007. *State-owned enterprise reform*. New York: United Nation Department for Economic and Social Affairs (UNDESA).
- Chen, M. J., & Miller, D. 2010. West meets east: Toward an ambicultural approach to management. *Academy of Management Perspectives*, 24(4): 17–24.
- D'Aunno, T., Succi, M., & Alexander, J. A. 2000. The role of institutional and market forces in divergent organizational change. *Administrative Science Quarterly*, 45(4): 679–703.
- DiMaggio, P. J., & Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2): 147–160.
- Drucker, P. 1985. *Innovation and entrepreneurship*. New York: Routledge.
- Elango, B., & Pattnaik, C. 2007. Building capabilities for international operations through networks: A study of Indian firms. *Journal of International Business Studies*, 38(4): 541–555.
- Filatotchev, I., Liu, X., Buck, T., & Wright, M. 2009. The export orientation and export performance of high-technology SMEs in emerging markets: The effects of knowledge transfer by returnee entrepreneurs. *Journal of International Business Studies*, 40(6): 1005–1021.
- Friedland, R., & Alford, R. R. 1991. Bringing society back in: Symbols, practices, and institutional contradictions. In W. W. In Powell & P. J. DiMaggio (Eds.), *The New institutionalism in organizational analysis* (pp. 232–263). Chicago: University of Chicago Press.
- Gorodnichenko, Y., & Roland, G. 2011. Individualism, innovation, and long-run growth. *Proceedings of the National Academy of Science*, 108: 21316–21319.
- Greenwood, R., & Hinings, C. 1996. Understanding radical organizational change: Bringing together the old and the new institutionalism. *Academy of Management Review*, 21(4): 1022–1054.
- Griffith, D. A., & Harvey, M. G. 2001. A resource perspective of global dynamic capabilities. *Journal of International Business Studies*, 32(3): 597–606.
- Grigoriou, K., & Rothaermel, F. T. 2017. Organizing for knowledge generation: Internal knowledge networks and the contingent effect of external knowledge sourcing. *Strategic Management Journal*, 38(2): 395–414.
- Groves, T., Hong, Y., McMillan, J., & Naughton, B. 1994. Autonomy and incentives in Chinese state enterprises. *Quarterly Journal of Economics*, 109(1): 183–209.
- Guan, J., & Yam, R. C. M. 2015. Effects of government financial incentives on firms' innovation performance in China: Evidences from Beijing in the 1990s. *Research Policy*, 44(1): 273–282.
- Harrison, A., Meyer, M., Wang, P., Zhao, L., & Zhao, M. 2019. Can a tiger change its stripes? Reform of Chinese state-owned enterprises in the penumbra of the state. *NBER Working Papers 25475*. Cambridge, MA: National Bureau of Economic Research, Inc.
- Hassard, J., Rees, C. J., Morris, J., Sheehan, J., & Xiao, Y. X. 2010. China's state-owned enterprises: Economic reform and organizational restructuring. *Journal of Organizational Change Management*, 23(5): 500–516.
- Hassard, J., Sheehan, J., Zhou, M., Terpstra-Tong, J., & Morris, J. 2007. *China's state-enterprise reform: From Marx to the market*. London: Routledge.
- Hofstede, G. 2001. *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations*. Thousand Oaks: Sage Publications.
- Hu, A. G. Z., Jefferson, G. H., & Qian, J. C. 2005. R&D and technology transfer: Firm-level evidence from Chinese industry. *Review of Economics and Statistics*, 87(4): 780–786.
- Hu, H. W., Cui, L., & Aulakh, P. S. 2019. State capitalism and performance persistence of business group-affiliated firms: A comparative study of China and India. *Journal of International Business Studies*, 50(2): 193–222.
- Huang, L. F. J., & Snell, R. S. 2003. Turnaround, corruption and mediocrity: Leadership and governance in three state-owned enterprises in Mainland China. *Journal of Business Ethics*, 43(1–2): 111–124.
- Jensen, M. C., & Meckling, W. H. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4): 305–360.
- Jia, N., Huang, K. G., & Zhang, C. M. 2019. Public governance, corporate governance, and firm innovation: An examination of state-owned enterprises. *Academy of Management Journal*, 62(1): 220–247.
- Kozminski, A. K. 1993. *Catching up? Organizational and management change in the ex-socialist block*. Albany: State University of New York Press.
- Kraatz, M. S., & Block, E. S. 2008. Organizational implications of institutional pluralism. In R. Greenwood, C. Oliver, R. Suddaby, & K. Sahlin-Andersson (Eds.), *The Sage handbook of organizational institutionalism* (pp. 243–275). London: Sage.
- Krishnan, R. T., & Prashantham, S. 2019. Innovation in and from India: The who, where, what, and when. *Global Strategy Journal*, 9(3): 357–377.
- Li, J., Xia, J., & Zajac, E. J. 2018. On the duality of political and economic stakeholder influence on firm innovation performance: Theory and evidence from Chinese firms. *Strategic Management Journal*, 39(1): 193–216.
- Liang, H., Ren, B., & Sun, S. L. 2015. An anatomy of state control in the globalization of state-owned enterprises. *Journal of International Business Studies*, 46(2): 223–240.
- Liegsalz, J., & Wagner, S. 2013. Patent examination at the State Intellectual Property Office in China. *Research Policy*, 42(2): 552–563.
- Liu, X., Lu, J., Filatotchev, I., Buck, T., & Wright, M. 2010. Returnee entrepreneurs, knowledge spillovers and innovation in high-tech firms in emerging economies. *Journal of International Business Studies*, 41(7): 1183–1197.
- Mahmood, I. P., & Rufin, C. 2005. Government's dilemma: The role of government in imitation and innovation. *Academy of Management Review*, 30(2): 338–360.
- March, J. 1991. Exploration and exploitation in organizational learning. *Organization Science*, 2(1): 71–87.
- Mariotti, S., & Marzano, R. 2019. Varieties of capitalism and the internationalization of state-owned enterprises. *Journal of International Business Studies*, 50(5): 669–691.
- Meggison, W. L., & Netter, J. R. 2001. From state to market: A survey of empirical studies on privatization. *Journal of Economic Literature*, 39(2): 321–389.
- Meyer, K. E., & Peng, M. W. 2016. Theoretical foundations of emerging economy business research. *Journal of International Business Studies*, 47(1): 3–22.
- Mudambi, R. 2011. Hierarchy, coordination, and innovation in the multinational enterprise. *Global Strategy Journal*, 1(3–4): 317–323.
- Musacchio, A., Lazzarini, S. G., & Aguilera, R. V. 2015. New varieties of state capitalism: Strategic and governance implications. *Academy of Management Perspectives*, 29(1): 115–131.
- Nee, V. 1989. A theory of market transition: From redistribution to markets in state socialism. *American Sociological Review*, 54(5): 663–681.
- Oliver, C. 1991. Strategic responses to institutional processes. *Academy of Management Review*, 16(1): 145–179.
- Oliver, C. 1997. Sustainable competitive advantage: Combining institutional and resource-based views. *Strategic Management Journal*, 18(9): 697–713.



- Orr, G., & Roth, E. 2012. A CEO's guide to innovation in China. *McKinsey Quarterly*, 1: 74–83.
- Pache, A. C., & Santos, F. 2010. When worlds collide: The internal dynamics of organizational responses to conflicting institutional demands. *Academy of Management Review*, 35(3): 455–476.
- Pache, A. C., & Santos, F. 2013. Inside the hybrid organization: Selective coupling as a response to competing institutional logics. *Academy of Management Journal*, 56(4): 972–1001.
- Peng, M. W., Ahlstrom, D., Carraher, S. M., & Shi, W. 2017. An institution-based view of global IPR history. *Journal of International Business Studies*, 48(7): 893–907.
- Pollitt, C., & Bouckaert, G. 2004. *Public management reform: A comparative analysis* (2nd ed.). Oxford: Oxford University Press.
- Porter, M. 1991. Toward a dynamic theory of strategy. *Strategic Management Journal*, 12(S2): 95–117.
- Ralston, D. A., Terpstra-Tong, J., Terpstra, R. H., Wang, X., & Egri, C. 2006. Today's state-owned enterprises of China: Are they dying dinosaurs or dynamic dynamos? *Strategic Management Journal*, 27(9): 825–843.
- Ramamurti, R., & Hillemann, J. 2018. What is "Chinese" about Chinese multinationals? *Journal of International Business Studies*, 49(1): 34–48.
- Ryan, T. P. 2008. *Modern regression methods* (2nd ed.). New York: Wiley.
- Schilling, M. A. 2015. Technology shocks, technological collaboration, and innovation outcomes. *Organization Science*, 26(3): 668–686.
- Schmidt, K. 1997. Managerial incentives and product market competition. *The Review of Economic Studies*, 64(2): 191–213.
- Schumpeter, J. A. 1942. *Capitalism, socialism, and democracy* (3rd ed.). New York: Harper and Brothers.
- Schwartz, S. H. 1994. *Cross-cultural research and methodology series. Individualism and collectivism: Theory, method, and applications* (Vol. 18). Thousand Oaks: Sage Publications Inc.
- Stiglitz, J. E. 1991. The invisible hand and modern welfare economics, *NBER working papers 3641*. Cambridge: National Bureau of Economic Research, Inc.
- Sun, Z. 2015. Technology innovation and entrepreneurial state: The development of China's high-speed rail industry. *Technology Analysis & Strategic Management*, 27(6): 646–659.
- Sytch, M., & Tatarynowicz, A. 2014. Exploring the locus of invention: The dynamics of network communities and firms' invention productivity. *Academy of Management Journal*, 57(1): 249–279.
- Tan, D., & Tan, J. 2017. Far from the tree? Do private entrepreneurs agglomerate around public sector incumbents during economic transition? *Organization Science*, 28(1): 113–132.
- Tan, J. 2002. Impact of ownership type on environment, strategy, and performance: Evidence from China. *Journal of Management Studies*, 39(3): 333–354.
- Tan, J., Li, S., & Xia, J. 2007. When iron fist, visible hand, and invisible hand meet: Firm-level effects of varying institutional environments in China. *Journal of Business Research*, 60(7): 786–794.
- Tan, J., & Litschert, R. J. 1994. Environment-strategy relationship and its performance implications: An empirical study of the Chinese electronics industry. *Strategic Management Journal*, 15(1): 1–20.
- Tan, J., & Peng, M. 2003. Organizational slack and firm performance during economic transitions: Two studies from an emerging economy. *Strategic Management Journal*, 24(13): 1249–1263.
- Tan, J., & Tan, D. 2005. Environment – Strategy coevolution and coalignment: A staged-model of Chinese SOEs under transition. *Strategic Management Journal*, 26(2): 141–157.
- Taylor, M. Z., & Wilson, S. 2012. Does culture still matter? The effects of individualism on national innovation rates. *Journal of Business Venturing*, 27(2): 234–247.
- Thornton, P. H., Ocasio, W., & Lounsbury, M. 2012. *The institutional logics perspective: A new approach to culture, structure, and process*. Oxford: Oxford University Press.
- Walsh, J. P., & Kosnik, R. D. 1993. Corporate raiders and their disciplinary role in the market for corporate control. *Academy of Management Journal*, 36(4): 671–700.
- Wang, C., Rodan, S., Fruin, M., & Xu, X. 2014. Knowledge networks, collaboration networks, and exploratory innovation. *Academy of Management Journal*, 57(2): 484–514.
- Xu, D., Lu, J. W., & Gu, Q. 2014. Organizational forms and multi-population dynamics: Economic transition in China. *Administrative Science Quarterly*, 59(3): 517–547.
- Zhou, K. Z., Gao, G. Y., & Zhao, H. 2017. State ownership and firm innovation in China: An integrated view of institutional and efficiency logics. *Administrative Science Quarterly*, 62(2): 375–404.
- Zhou, K. Z., Tse, D. K., & Li, J. J. 2006. Organizational changes in emerging economies: Drivers and consequences. *Journal of International Business Studies*, 37(2): 248–263.

APPENDIX 1: CONCEPTUAL SUPPLEMENT

See Table 5.

**Table 5** Disentangling state ownership and affiliation: dissonance-based mechanisms

Institutional factors	State ownership		State affiliation		Tensions between ownership and affiliation	
	Contextualized factors	Dissonance implications (organizational means-end designation)	Contextualized factors	Dissonance implications	Contextualized factors	Dissonance implications
Internal representations	State-appointed leadership at state-owned firms (e.g., top executive and managers) controls major strategic decisions	<i>Internal</i> institutional actors to represent the hierarchy demands <i>Amplified</i> internal representations of hierarchy-based norms (cultures) Organization is <i>inert</i> to adopt market-based organizational practices (e.g., risk avoidance, preservation of collectivistic cultures)	State-referred board members and advisory committees monitor firms externally; the state prioritizes the development of the state-affiliated firms' specialization areas	<i>External</i> institutional actors to represent the hierarchy demands <i>Diminished</i> internal representations of hierarchy-based norms (cultures) Organization is <i>facilitated</i> to adopt market-based organizational practices (e.g., efficiency-driven, encouragement of innovation/creativity)	State-appointed executives (managers) and state-referred external board members (advisors) engage in collusive (corruptive) practices State-referred boards and advisors are held highly accountable for firm development	<i>Ownership exerts stronger influences:</i> socialistic norms (cultures) permeate across the organizational boundary <i>Affiliation exerts stronger influences:</i> properly implemented external monitoring facilitates the development of efficiency-driven norms (cultures) <i>Ownership exerts stronger influences:</i> external and internal representatives of the state converge in acquiescence to hierarchy-based goals
Ideological goal enactment	State-appointed decision makers at the firm acquiesce to socialistic conducts (e.g., status quo maintenance, political advancement)	<i>Weak</i> enactment of ideological goals of the state as the internal representatives face high conformity pressures from hierarchy-based norms (cultures) in the organization <i>Amplified</i> hierarchy-market inconsistencies in organizational goals Organization <i>deviates</i> from economic objectives (e.g., acquiescence to social (political) objectives)	External monitoring, organizational autonomy, and fiduciary duties to private shareholders align managerial incentives to the firm's economic objectives	<i>Strong</i> enactment of ideological goals of the state as the external representatives face low conformity pressures from hierarchy-based norms (cultures) in the organization <i>Diminished</i> hierarchy-market inconsistencies in organizational goals Organization <i>adheres</i> to economic organizational objectives	State shareholders and external board (advisory committee) agree to emphasize home-grown technologies and/or employment protection, in spite of low efficiency State-referred boards and advisors are held highly accountable for firm development	<i>Affiliation exerts stronger influences:</i> properly implemented external monitoring market-based goals



Table 5 (Continued)

Institutional factors	State ownership		State affiliation		Tensions between ownership and affiliation	
	Contextualized factors	Dissonance implications (organizational means-end designation)	Contextualized factors	Dissonance implications	Contextualized factors	Dissonance implications
Institutional mean legitimacy	The state uses political planning to grant exclusive resource allocation for state-owned firm development	State-prescribed means are <i>not legitimized</i> in the market institutional sphere <i>Amplified</i> hierarchy-market inconsistencies in organizational means <i>Low</i> managerial incentives to adopt market principles	State affiliation facilitates inter-organizational collaborations for firm development (e.g., university–firm collaborations, domestic and cross-border joint ventures)	State-prescribed means are <i>legitimized</i> in the market institutional sphere <i>Diminished</i> hierarchy-market inconsistencies in organizational means <i>High</i> managerial incentives to adopt market principles	Political planning overshadows organizational learning Inter-organizational collaborations increase market scrutiny	<i>Ownership exerts stronger influences:</i> efficiency-based means are not fully exploited due to firm dependence and complacency <i>Affiliation exerts stronger influences:</i> market scrutiny curtails dependence (complacency) and strengthens efficiency-based means
Consequences on change implementation and innovation improvement	<i>Elevated</i> organizational resistance to market-based changes; <i>Low</i> innovation improvements through organizational restructuring		<i>Decreased</i> organizational resistance to market-based changes; <i>High</i> innovation improvements through organizational restructuring		(1) If ownership eclipses affiliation, change implementation is less effective for innovation development in state-affiliated, state-owned firms than state-affiliated, privatized firms; (2) If affiliation out-shines ownership, change implementation is equally effective for state-affiliated firms that are state-owned or privatized, but it is more effective for state-owned, state-affiliated firms than state-owned, non-affiliated firms	



APPENDIX 2: ADDITIONAL ANALYSIS

See Tables 6, 7 and 8.

Table 6 Random-effect OLS panel regression results on firm-year invention patent publication

Independent and control variables	Dependent variable: invention patent publication counts (log transformed)					
	Model II-1	Model II-2	Model II-3	Model II-4	Model II-5	Model II-6
Firm revenue	0.0861 (0.0483) <i>(0.075)</i>	0.0899 (0.0481) <i>(0.062)</i>	0.0882 (0.0471) <i>(0.061)</i>	0.118 (0.0451) <i>(0.009)</i>	0.0928 (0.0479) <i>(0.053)</i>	0.115 (0.0427) <i>(0.007)</i>
Firm profit	0.0158 (0.0184) <i>(0.392)</i>	0.0103 (0.0184) <i>(0.575)</i>	0.0106 (0.0183) <i>(0.562)</i>	− 0.0104 (0.0179) <i>(0.562)</i>	0.00955 (0.0184) <i>(0.604)</i>	− 0.0102 (0.0177) <i>(0.563)</i>
Firm size	0.109 (0.0517) <i>(0.034)</i>	0.119 (0.0505) <i>(0.019)</i>	0.120 (0.0511) <i>(0.019)</i>	0.113 (0.0489) <i>(0.021)</i>	0.115 (0.0514) <i>(0.025)</i>	0.114 (0.0495) <i>(0.021)</i>
R&D employees	0.0691 (0.0362) <i>(0.056)</i>	0.0680 (0.0357) <i>(0.057)</i>	0.0662 (0.0356) <i>(0.063)</i>	0.101 (0.0348) <i>(0.004)</i>	0.0743 (0.0359) <i>(0.039)</i>	0.105 (0.0350) <i>(0.003)</i>
State affiliation	0.0589 (0.147) <i>(0.688)</i>	0.101 (0.151) <i>(0.505)</i>	0.106 (0.147) <i>(0.471)</i>	− 0.490 (0.151) <i>(0.001)</i>	1.233 (0.460) <i>(0.007)</i>	1.661 (0.504) <i>(0.001)</i>
State ownership	0.412 (0.187) <i>(0.028)</i>	0.433 (0.186) <i>(0.020)</i>	0.495 (0.256) <i>(0.053)</i>	0.246 (0.144) <i>(0.087)</i>	0.547 (0.224) <i>(0.014)</i>	1.008 (0.216) <i>(0.000)</i>
Organizational restructuring		0.311 (0.0972) <i>(0.001)</i>	0.464 (0.491) <i>(0.344)</i>	− 0.255 (0.0997) <i>(0.010)</i>	0.308 (0.0971) <i>(0.002)</i>	1.234 (0.486) <i>(0.011)</i>
State ownership × restructuring			− 0.0815 (0.258) <i>(0.752)</i>			− 0.794 (0.251) <i>(0.002)</i>
State affiliation × restructuring				0.919 (0.165) <i>(0.000)</i>		− 0.928 (0.665) <i>(0.163)</i>
State affiliation × state ownership					− 0.595 (0.224) <i>(0.008)</i>	− 1.119 (0.238) <i>(0.000)</i>
State affiliation × state ownership × restructuring						0.983 (0.355) <i>(0.006)</i>
Constant	− 2.289 (0.358) <i>(0.000)</i>	− 2.420 (0.356) <i>(0.000)</i>	− 2.529 (0.538) <i>(0.000)</i>	− 1.907 (0.296) <i>(0.000)</i>	− 2.613 (0.386) <i>(0.000)</i>	− 3.314 (0.453) <i>(0.000)</i>
Observation	1849	1849	1849	1849	1849	1849
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Firm-clustered robust standard errors in parentheses; *p* values in italics and in parentheses.

**Table 7** Random-effect OLS panel regression results on firm-year invention patent conversion ratio

Independent and control variables	Dependent variable: invention patent conversion ratio					
	Model II-7	Model II-8	Model II-9	Model II-10	Model II-11	Model II-12
Firm revenue	0.0159 (0.00968) <i>(0.101)</i>	0.0163 (0.00980) <i>(0.095)</i>	0.0161 (0.00971) <i>(0.097)</i>	0.0222 (0.00934) <i>(0.017)</i>	0.0172 (0.00966) <i>(0.074)</i>	0.0220 (0.00905) <i>(0.015)</i>
Firm profit	0.00346 (0.00389) <i>(0.373)</i>	0.00255 (0.00398) <i>(0.521)</i>	0.00264 (0.00398) <i>(0.507)</i>	− 0.00178 (0.00399) <i>(0.656)</i>	0.00233 (0.00399) <i>(0.558)</i>	− 0.00177 (0.00400) <i>(0.659)</i>
Firm size	0.0240 (0.0123) <i>(0.052)</i>	0.0253 (0.0123) <i>(0.039)</i>	0.0255 (0.0123) <i>(0.038)</i>	0.0227 (0.0118) <i>(0.054)</i>	0.0240 (0.0124) <i>(0.052)</i>	0.0228 (0.0119) <i>(0.056)</i>
R&D employees	0.0147 (0.00879) <i>(0.094)</i>	0.0147 (0.00882) <i>(0.096)</i>	0.0143 (0.00892) <i>(0.108)</i>	0.0221 (0.00883) <i>(0.012)</i>	0.0166 (0.00902) <i>(0.066)</i>	0.0230 (0.00898) <i>(0.010)</i>
State affiliation	0.0140 (0.0303) <i>(0.643)</i>	0.0213 (0.0316) <i>(0.500)</i>	0.0222 (0.0313) <i>(0.479)</i>	− 0.100 (0.0318) <i>(0.002)</i>	0.266 (0.0977) <i>(0.007)</i>	0.255 (0.0750) <i>(0.001)</i>
State ownership	0.0954 (0.0428) <i>(0.026)</i>	0.0985 (0.0423) <i>(0.020)</i>	0.105 (0.0374) <i>(0.005)</i>	0.0618 (0.0360) <i>(0.086)</i>	0.126 (0.0517) <i>(0.015)</i>	0.180 (0.0308) <i>(0.000)</i>
Organizational restructuring		0.0489 (0.0248) <i>(0.049)</i>	0.0665 (0.0617) <i>(0.281)</i>	− 0.0676 (0.0230) <i>(0.003)</i>	0.0480 (0.0248) <i>(0.053)</i>	0.153 (0.0699) <i>(0.029)</i>
State ownership × restructuring			− 0.00943 (0.0324) <i>(0.771)</i>			− 0.117 (0.0389) <i>(0.003)</i>
State affiliation × restructuring				0.193 (0.0383) <i>(0.000)</i>		− 0.0616 (0.0763) <i>(0.419)</i>
State affiliation × state ownership					− 0.129 (0.0506) <i>(0.011)</i>	− 0.184 (0.0357) <i>(0.000)</i>
State affiliation × state ownership × restructuring						0.134 (0.0487) <i>(0.006)</i>
Constant	4.111 (0.0968) <i>(0.000)</i>	4.093 (0.0951) <i>(0.000)</i>	4.082 (0.0897) <i>(0.000)</i>	4.192 (0.0835) <i>(0.000)</i>	4.046 (0.105) <i>(0.000)</i>	3.975 (0.0824) <i>(0.000)</i>
Observation	1856	1856	1856	1856	1856	1856
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Firm-clustered robust standard errors in parentheses; *p* values in italics and in parentheses.

**Table 8** Random-effect OLS panel regression results on firm-year R&D employee productivity

Independent and control variables	Dependent variable: invention patent conversion ratio					
	Model II-13	Model II-14	Model II-15	Model II-16	Model II-17	Model II-18
Firm revenue	0.0137 (0.0112) <i>(0.219)</i>	0.0150 (0.0112) <i>(0.180)</i>	0.0144 (0.0110) <i>(0.190)</i>	0.0192 (0.0105) <i>(0.068)</i>	0.0153 (0.0111) <i>(0.169)</i>	0.0182 (0.0101) <i>(0.071)</i>
Firm profit	0.00469 (0.00464) <i>(0.313)</i>	0.00359 (0.00466) <i>(0.441)</i>	0.00354 (0.00466) <i>(0.447)</i>	0.000103 (0.00463) <i>(0.982)</i>	0.00346 (0.00466) <i>(0.458)</i>	0.0000557 (0.00462) <i>(0.990)</i>
Firm size	0.0303 (0.0257) <i>(0.239)</i>	0.0328 (0.0256) <i>(0.199)</i>	0.0333 (0.0255) <i>(0.192)</i>	0.0363 (0.0259) <i>(0.161)</i>	0.0322 (0.0257) <i>(0.210)</i>	0.0369 (0.0261) <i>(0.158)</i>
R&D employees	- 0.0132 (0.0311) <i>(0.672)</i>	- 0.0142 (0.0317) <i>(0.654)</i>	- 0.0147 (0.0316) <i>(0.643)</i>	- 0.00989 (0.0328) <i>(0.763)</i>	- 0.0128 (0.0320) <i>(0.689)</i>	- 0.00921 (0.0332) <i>(0.781)</i>
State affiliation	0.0839 (0.0522) <i>(0.108)</i>	0.0923 (0.0525) <i>(0.079)</i>	0.0937 (0.0521) <i>(0.072)</i>	- 0.0155 (0.0556) <i>(0.780)</i>	0.310 (0.0852) <i>(0.000)</i>	0.319 (0.0805) <i>(0.000)</i>
State ownership	0.0700 (0.0389) <i>(0.072)</i>	0.0739 (0.0389) <i>(0.057)</i>	0.0965 (0.0454) <i>(0.033)</i>	0.0419 (0.0359) <i>(0.243)</i>	0.0948 (0.0463) <i>(0.040)</i>	0.159 (0.0359) <i>(0.000)</i>
Organizational restructuring		0.0673 (0.0226) <i>(0.003)</i>	0.119 (0.0619) <i>(0.054)</i>	- 0.0288 (0.0273) <i>(0.292)</i>	0.0668 (0.0225) <i>(0.003)</i>	0.193 (0.0406) <i>(0.000)</i>
State ownership × restructuring			- 0.0276 (0.0332) <i>(0.405)</i>			- 0.119 (0.0284) <i>(0.000)</i>
State affiliation × restructuring				0.156 (0.0439) <i>(0.000)</i>		- 0.0719 (0.0798) <i>(0.368)</i>
State affiliation × state ownership					- 0.115 (0.0455) <i>(0.012)</i>	- 0.174 (0.0386) <i>(0.000)</i>
State affiliation × state ownership × restructuring						0.121 (0.0495) <i>(0.014)</i>
Constant	- 0.375 (0.0978) <i>(0.000)</i>	- 0.404 (0.0973) <i>(0.000)</i>	- 0.446 (0.111) <i>(0.000)</i>	- 0.327 (0.102) <i>(0.001)</i>	- 0.440 (0.105) <i>(0.000)</i>	- 0.545 (0.0947) <i>(0.000)</i>
Observation	1812	1812	1812	1812	1812	1812
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Firm-clustered robust standard errors in parentheses; *p* values in italics and in parentheses

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Accepted by Jaideep Anand, Guest Editor, 5 May 2020. This article has been with the authors for four revisions.