Government-business relations and strategic patenting: evidence from China's patent boom

Ruoyan Zhu
Peking University, Beijing, China, and
Yin Li and Li Tang
Fudan University, Shanghai, China

Received 11 August 2022
Revised 1 February 2023
Accepted 16 March 2023

Abstract

Purpose – The purpose of the study is to propose a new perspective to explain how China's rapid growth in patenting is partially driven by corporate strategic patenting to influence local governments. The authors highlight the role of strategic patenting and local government-business relations in creating the gap between the patent boom and underlying technological progress in China.

Design/methodology/approach – The authors investigate the relationship between local government-business relations and corporate strategic patenting behaviors, measured as a higher ratio of patent filings to patent awards, by collecting data from three successive NADS surveys of government-business relations in 292 Chinese municipalities, paired with detailed patenting and subsidy data of 3,756 publicly listed corporations obtained through text mining.

Findings – The authors find that, while R&D investment and patent subsidies do drive corporate patenting, firms in jurisdictions with lower-quality government-business relations are more likely to engage in strategic patenting. Moreover, the negative impact of government-business relations on strategic patenting is moderated by political connections, as the strategic patenting of firms without political connections is more sensitive to government-business relations. The authors further show that firms obtain significant benefits from patenting in the form of additional subsidies from local innovation and industrial policies in the years following.

Social implications – Rolling back patent subsidies will reduce strategic patenting to a limited extent. The local governments in emerging markets need to increase the capacity to implement industrial policy and provide market-based opportunities for firms to access innovation inputs.

Originality/value – The authors provide an updated and fresh perspective to understand the phenomenon of China's patent boom by showing that patenting can be driven by corporate strategies to adapt to local institutions and influence government policy. The authors extend the analysis of strategic patenting to emerging markets.

Keywords Strategic patenting, Government-business relations, Institutional theory, China's patent boom

Paper type Research paper

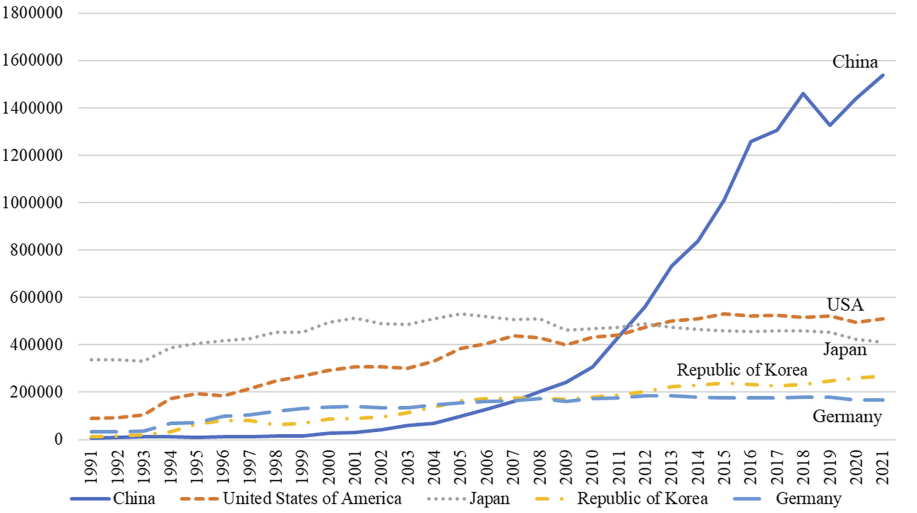
1. Introduction

One of the biggest puzzles in studying innovation in emerging markets is how and why China has become the world's largest patenting nation over the last two decades (Hu *et al.*, 2017; Lin *et al.*, 2021). Since 2012, China has been positioned as the world's top patenting country by the number of domestic patent applications. According to the World Intellectual Property Organization (WIPO) [1], in 2021, China filed more than 1.5 million international Patent Cooperation Treaty (PCT) patents, greater than the combined total of USA, Japan, the Republic of Korea and Germany (Figure 1). A number of explanations have been put forward to understand China's patenting boom. Some analysts argue the patent boom is commensurate with technological progress (Dang and Motohashi, 2015; Hu and Jefferson, 2009) or changes in the legal system (Hu and Jefferson, 2014), while many scholars underscore the role of government subsidies in inflating the number of patents (Li, 2012; Lei *et al.*, 2012)

Funding: This work is supported by the National Natural Science Foundation of China [71904029].

International Journal of Emerging Markets
Vol. 20 No. 2, 2025
pp. 515-536

1746-8809
DOI 10.1108/IJOEM-08-2022-1255



Source(s): World Intellectual Property Organization

Figure 1.
Total patent applications (direct and PCT national phases) by China, Japan, the USA, Republic of Korea and Germany (1991–2021)

observing the general low quality and non-competitiveness of Chinese patents (Liang, 2012; Squicciarini *et al.*, 2013; Shen *et al.*, 2018; Boeing and Mueller, 2016).

In spite of the myriad explanations revealed by previous research, we know surprisingly little about what motivates Chinese firms to patent, particularly for non-innovation strategic reasons. Economists and management scholars have long pointed out that firms file for patents for a variety of reasons other than protecting innovations, a behavior known as "strategic patenting" (Khan, 2005; Wright, 1983; Cohen *et al.*, 2000). Yet such strategic use of patents to manipulate markets is mostly documented for firms in developed economies (Farrell and Shapiro, 2008; Noel and Schankerman, 2013; Hall and Ziedonis, 2001; Ziedonis, 2004), while what drives firms in emerging economies to patent strategically remains largely underexplored. For example, Chinese firms are known to behave strategically in innovation activities often through forming tacit alliances with local governments to overcome structured uncertainties resulted from underdeveloped institutions (Breznitz and Murphree, 2011; Tang *et al.*, 2016; Murphree *et al.*, 2016; Li, 2022).

In this study, we propose a new perspective to explain how China's rapid growth in patenting is partially driven by corporate strategic patenting to adapt to local government-business relations. We extend insights from the theory of institutional voids (Khanna and Palepu, 1997; Khanna and Rivkin, 2001), and posit that in China's local political economy, patenting also plays the role of a networking resource and signaling tool in influencing the local governments. Utilizing the regional variations of the qualities of government-business relations, we investigate whether firms patent strategically in response to local government-business relations. We constructed a unique dataset of 3,756 publicly listed Chinese corporations with detailed patenting and subsidy data paired with information from three successive surveys of government-business relations in 292 municipalities in China between 2017 and 2019.

Our study makes several contributions to the extant work. First and foremost, we offer a fresh and updated evidence on the factors contributing to China's patent boom. While in recent literature, scholars have begun to explore non-innovation-related motivations for Chinese patenting, they usually assume such motivations are driven by government subsidies (see, for example, Hu *et al.*, 2017; Lin *et al.*, 2021). Our results reveal that firms are not simply responding to subsidies; on the contrary, firms take a proactive role in strategically

using patenting as a tool of networking and signaling for their own benefits. Strategic patenting thus provides a new lens through which to understand the formation and implementation of industrial policy at the local level in China. Second, we extend the analysis of strategic patenting to emerging markets by incorporating insights from the institutional void theory. We argue that strategic patenting is not limited to firm strategies in developed markets and can be understood as a non-market solution to institutional voids in emerging economies. Third, the Chinese context contributes to our understanding of strategic patenting in emerging markets.

The rest of the paper is organized as follows. In Section 2, we review the literature on China's patent boom and different types of explanations. In Section 3, we elaborate a theoretical framework to explain how the quality of local government-business relations could influence strategic patenting. Section 4 describes the data. We outline the empirical analysis and present the main results in Section 5 and followed by robustness checks in Section 6. Section 7 concludes the paper.

2. Literature review

In existing studies, there are three prevailing explanations for China's patent boom. The first views patents as an indicator of technological innovation and argue the boom of patent filings is likely commensurate with technological progress in China. Wei *et al.* (2017) noted the R&D intensity of China's economy, measured by the ratio of R&D expenditure, has increased dramatically, from 0.5% for much of the 1990s to more than 2% in the mid-2010s, a level close to that of developed industrial economies. Some researchers reveal that patent counts in general correlate with R&D input and financial output in China (Dang and Motohashi, 2015), while others find that China's rising R&D intensity explains only a fraction of the patent explosion (Hu and Jefferson, 2009).

A second line of explanation focuses on the legal function of patents, as the boom in patent filings could be driven by changes in the legal system that strengthened intellectual property protections. China's 1984 Patent Law has undergone two major amendments in 1993 and 2000, both of which have led to fast growth in patenting in subsequent years. Hu and Jefferson (2009) find that not only does the strengthened patent law favor patent holders and increase patenting, but ownership reform that clarifies private property rights also prompts Chinese firms to patent more. As domestic Chinese firms grow and competition with foreign firms intensifies in the Chinese market, foreign firms also increasingly rely on applications for Chinese patents to protect their intellectual property (Hu and Jefferson, 2014).

The third explanation examines the effects of the Chinese government's patent subsidy programs on the boom in patent filings. In 1999, Shanghai first introduced a patent subsidy program that reimbursed firms for patent fees (Li, 2012). Soon all Chinese provincial governments and many municipal governments followed the suit and adopted some form of patent subsidy policies, which immediately boosted patent applications (Li, 2012). Lei *et al.* (2012) examine a natural experiment in Jiangsu province in 2006, in which the city of Zhangjiagang significantly increased the amount of subsidy per patent application while policies in its four neighboring cities remained unchanged. They find that increased subsidy drives up the number of patent applications but reduces the quality of patents. In a bibliometric analysis of SIPO [2] patent information and industrial survey data from 1998 to 2007, Dang and Motohashi (2015) estimate that patent subsidy programs increased patenting quantity by more than 20%.

In sum, the existing literature touches on multiple aspects of policies and patenting behaviors in China with an emerging consensus that Chinese patenting has significantly outgrown the real rate of technological innovation. The extant studies acknowledge the role of government's subsidies to the discrepancy between patenting and innovation, but it is

unclear what motivates Chinese companies to patent to such an extent. To better understand the drivers of patenting, we investigate the institutional background that motivates firm patenting, especially for non-innovation purposes.

3. Theoretical framework and hypotheses

The critical role of institution in shaping the behaviors of firms has been well studied in the context of developed economies (DiMaggio and Powell, 1983). In comparison, market-supporting formal institutions is far from sufficient in emerging markets (Banerji *et al.*, 2002; Peng, 2003). This characteristic of emerging markets is often called "institutional voids", referring to a lack of specialized intermediaries, regulatory systems and contract-enforcing mechanisms (Khanna and Palepu, 1997). Operating in these markets, firms have to perform these basic functions themselves without the benefit of specialized intermediaries so as to survive and thrive over time (Khanna and Palepu, 1997; Khanna and Rivkin, 2001). In other words, firms in emerging markets, compared to their counterparts in the developed economies need to fill institutional voids either through market solutions (i.e. internalization and substitutions) or nonmarket solutions (Funk and Hirschman, 2017; Doh *et al.*, 2017; Cantwell *et al.*, 2010). Because inefficient capital markets and a bureaucratic environment usually place limits on the company's ability to adopt market options, firms often turn to nonmarket solutions to mitigate institutional voids such as network strategy and signaling strategy.

Networking with the government allows the firms to exert influence and compensate for the institutional underdevelopment (Ge *et al.*, 2019; Manolova *et al.*, 2019; Sydow *et al.*, 2022; Wang *et al.*, 2022). In China, patenting can serve as a useful resource to influence local government officials. Over the last decades, patents have become an important metrics for evaluating local officials in their promotions in alignment with China's national development strategy that shifted away from economic growth quantified by gross domestic products (GDP) to innovation-driven development (Chen *et al.*, 2021; Tang *et al.*, 2016; Teets *et al.*, 2017). In 2013, the Organization Department of the Chinese Communist Party's Central Committee issued the "Notice on Improving the Performance Evaluation of Local Cadres" [3]. The document identifies technological innovation as one of the indicators that should be more highly valued when evaluating local cadres' performance. In 2015, the Central Committee issued "Several Opinions on Deepening the Reform of Institutional Mechanisms and Accelerating the Implementation of the Strategy of Innovation-Driven Development" [4], officially bringing the achievements in innovation into the performance evaluation of local cadres. For example, the local government of Guangdong Province explicitly stated in 2016 that the evaluation of officials shall involve ten indicators, including but not limited to the number of patent applications and grants per 10,000 people and the number of high-tech enterprises [5]. By increasing the number of patents in the locality, firms contribute to the metrics for local officials in their career advancement (Shen *et al.*, 2018). Given the central role of Chinese local governments in promoting growth (Montinola *et al.*, 1995; Xu, 2011; Caulfield, 2006) and designing and implementing industrial policy (Tsai, 2006, 2007; Li, 2022), patenting would empower firms to influence the local government, which would in turn promote and sustain firm growth in the long run.

A signaling strategy is about demonstrating a level of credibility and convey information to others, reducing transaction costs in markets with informal institutions governing market exchange (Spence, 2002; Sliwka, 2007; Su *et al.*, 2016; Doh *et al.*, 2017). Firms use patents to protect the appropriability of innovations, but they also use patents to demonstrate their innovativeness for various purposes (Farrell and Shapiro, 2008; Li *et al.*, 2015; Noel and Schankerman, 2013; Hall and Ziedonis, 2001; Ziedonis, 2004). In China, patenting signals the firm's potential innovativeness, allowing local governments to identify candidates for

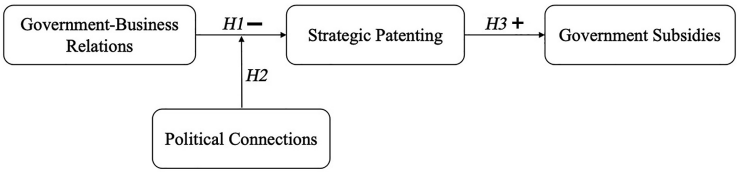
industry promotion (Feng and Jiang, 2021). Since the implementation of "The Administrative Measures for Determination of High and New Technology Enterprises" in 2008, patenting has been an important metric in certifying high- and new-technology enterprises (hereinafter HTE). Being certified as an HTE confers numerous benefits, ranging from cash subsidies, tax incentives, access to financial markets, land acquisitions and preferential status in a number of areas concerning finance, human resources and policy priorities. In addition to the standard benefits outlined by the national government, local governments often offer additional incentives to HTEs in their jurisdictions. Such local incentives range from cash bonuses to free housing for talent and/or the provision of industrial land. It should be noted that the HTE certification is issued by local office which consists of government officials in the science and technology, public finance, and taxation departments. Given their general lack of expertise to evaluate high-tech firms, the number of patents is often served as one of the most important metrics for certifying HTEs (Feng and Jiang, 2021). As a result, filing patents signals firms' technological capacity to capture attentions from the local government.

Stimulated by the insights from the theory of institutional voids, we argue that patenting in China is partially driven by networking and signaling motives to influence the local government, which in turn allows firms to obtain resources and overcome underdeveloped institutions. In this context, patenting is a strategic behavior in response to local government-business relations instead of protecting the firm's innovation outcomes. In other words, China's large number of relatively low-quality patents could be partially driven by corporate strategic patenting. This central proposition allows us to derive three testable hypotheses (Figure 2).

First, since corporate strategic patenting increases the number of patents in the locality and improves metrics for local officials in their evaluation, it can be turned into a networking resource to influence local government in order to address underdeveloped institutions (Ge *et al.*, 2019; Manolova *et al.*, 2019; Sydow *et al.*, 2022; Wang *et al.*, 2022), especially when the quality of local government-business relations is low (Nie *et al.*, 2018, 2019, 2020). Consequently, firms are inclined to engage in strategic patenting to adopt to varying qualities of local government-business relations. The motives will be especially strong when firms are reliant on the local government to supply various inputs to innovation, from finance to human capital to adequate intellectual property protection, especially in less developed regions of China where the quality of local government-business relations is low. Therefore, we posit that:

H1. The quality of local government-business relations has a negative impact on corporate strategic patenting.

Second, strategic patenting is likely one of the many tools that Chinese firms employ to influence government and address institutional voids. The literature has long highlighted that interpersonal connections (pinyin: *guanxi* 关系) play a central role in facilitating exchanges and transactions between businesses and governments (Chan *et al.*, 2015; Huang, 2011). It is intuitive to assume political connections between the firm's executives and



Source(s): Author's own creation

Figure 2. Framework and hypotheses

government officials would substitute for strategic patenting in influencing the government policies. In other words, political connections should have a moderating effect if the hypothesized causal mechanism between government-business relations and strategic patenting holds. Accordingly, we hypothesize that:

H2. Political connections have a moderating effect on the impact of government-business relations.

Finally, strategic patenting serves as a signaling mechanism to demonstrate the firm's innovativeness to local governments due to potential high transaction costs of securing innovation resources (Spence, 2002; Sliwka, 2007; Su *et al.*, 2016; Doh *et al.*, 2017). Such signaling is especially useful when local government officials lack the infrastructure to promote innovative performance and are less capable of identifying potential innovators to support. Patenting as a signaling mechanism thus allows firms to secure resources for innovative activities, which in China are usually in the form of government subsidies and various supporting schemes in the local industrial policy. Therefore, we propose the following hypothesis:

H3. Strategic patenting has a positive effect on acquiring local government subsidies in the years following.

4. Data and measurement

To test the hypotheses, we combine data from several data sources to construct measurements of government-business relations and strategic patenting. Our primary data sources include surveys on prefecture-level government-business relations conducted by researchers at Renmin University of China (Nie *et al.*, 2018, 2019, 2020) and corporate patenting and financial data for public companies collected by the Chinese Research Data Services (CNRDS) Database, Wind-Economic database and China Stock Market and Accounting Research Database (CSMAR). We also adopt a novel method of text mining to extract subsidy data from the corporate public disclosures.

4.1 Government-business relations index

The key independent variable in our study is the government-business relations index. We obtain the indicators on prefecture-level local government-business relations from the "Chinese City Rankings on Government-Business Relations Report" (*中国城市政商关系排行榜*) published by the National Academy of Development and Strategy (NADS) at Renmin University of China (Nie *et al.*, 2018, 2019, 2020). The NADS survey is based on the methodology that government-business relations in China have two dimensions: how close the relations are in terms of the government's interest in, services provided to, and taxes raised from business, and how much integrity the government maintains (Nie *et al.*, 2018). The two dimensions are known as the "closeness" (pinyin: *qinjin* 亲近) index and the "integrity" (pinyin: *qingbai* 清白) index, respectively. The NADS government-business relations index is constructed from 11 weighted indicators categorized into five groups (Table 1). The five groups examine different facets of government-business relations, including government interest in businesses, government services provided to businesses, business tax burdens, government transparency, and government integrity. Each indicator is operationalized by one or two measurements. For example, indicator group A of the Care Index, which examines government interest in business, includes two indicators and is measured by the frequency of the city leadership's (i.e. the mayor and party secretary) visits to firms. A detailed explanation of the measurements is documented in Table 1. For more information about government-business relations index, please refer to Nie *et al.* (2018, 2019, 2020).

NADS's Government-Business Relations Index

Sub-dimensions	Indicator groups	Indicators	Measurement
Closeness Index	A: Care Index (Government interest in business) (10%)	A1: Local leadership visits (5%)	Num. of leadership (mayor, party secretary)'s visits to firms
		A2: Local leadership talks (5%)	Num. of leadership talks with entrepreneurs
	B: Service Index (Government service provided to business) (40%)	B1: Infrastructure (10%)	Road area/Urban area
			High speed rail frequency
		B2: Financial service (10%)	Balance of deposits and loans/GDP
			Financial workforce/Urban population
			Num. of bank branches/Urban population
		B3: Market intermediary (10%)	Num. of lawyer's offices/Urban population
			Num. of accounting firms/Urban population
		B4: E-government (10%)	Government online services and efficiency
			Government services via mobile Internet (WeChat and Weibo)
	C: Burden Index (Business tax burden) (10%)	C1: Tax burden to firms (10%)	Sales tax and associated charges on manufacturing firms with scales/ Total industrial output
			Value-added tax/Total industrial output
Integrity Index	D: Cleanness Index (10%)	D1: Food safety certificate costs (5%)	Food safety certificate costs
		D2: Baidu corruption index (5%)	Num. of news on corruption cases/ all news
	E: Transparency Index (30%)	E1: Government information disclosure (15%)	Online information disclosure
		E2: Fiscal transparency (15%)	Fiscal transparency

Source(s): The National Academy of Development and Strategy (NADS) at the Renmin University of China

Table 1. NADS's government-business relations index

We use the NADS data published in 2018, 2019, and 2020. The NADS ranking data is adopted as government-business relations index is based on the following considerations: First, the NADS data has good coverage. The 2018 ranking covers 285 out of all 293 prefecture-level cities in China, while the 2019 and 2020 rankings cover all of them. Second, the rankings index was constructed based on a variety of data sources, including official statistics, Internet data, and firm-level surveys, providing a comprehensive set of indicators related to government-business relations and local institutional quality. Finally, the NADS ranking report discloses all data on indicators. Thus, we can not only measure the overall quality of government-business relations but also trace their effects to specific indicators.

4.2 Strategic patenting

The main dependent variable in this study is corporate strategic patenting. We construct this indicator based on the reciprocal of the patent-grant ratio to measure the extent to which Chinese firms engage in inflating patent applications, or, in other words, strategic patenting.

Patent-grant ratio is a widely used indicator of patent quality at the aggregate level of a country, region, or firm (Li, 2012). Our indicator of strategic patenting, or ***SP***, is constructed as the number of patent filings divided by the number of patent grants of the firm in a given year, i.e. $SP = \frac{Number\ of\ patent\ applications}{Number\ of\ patent\ grants}$. As a reciprocal of the patent grant ratio, the ***SP*** indicator increases when the firm files more low-quality patent applications for non-innovation purposes, which would result in a drop in average patent quality. Therefore, the ***SP*** indicator is a proxy for the Chinese firm's strategic patenting behaviors. To construct the ***SP*** indicator, we obtain firm-level patenting data of Chinese publicly listed firms from the Chinese Research Data Services (CNRDS) Database, including the annual number of patent filings and grants with the Chinese Patent Office.

4.3 Political connections

Political connections serve as a moderator variable to test the causal mechanism between government-business relations and strategic patenting. We conceptualize political connections as the interpersonal relations between the firm's executives and local government officials, which would substitute for strategic patenting in securing better relations with the government. In other words, when a firm has political ties, the effect of government-business relations on its strategic patenting behaviors is diminished. We follow the literature to measure political connections by using a dummy variable, which is denoted as 1 if any of the firm's executives hold an official position [6] and 0 if otherwise (Lin *et al.*, 2014; Zhang *et al.*, 2014; Su *et al.*, 2019). This measure is independent of the government-business relations index, and the data are collected from the China Stock Market and Accounting Research Database (hereinafter CSMAR) database.

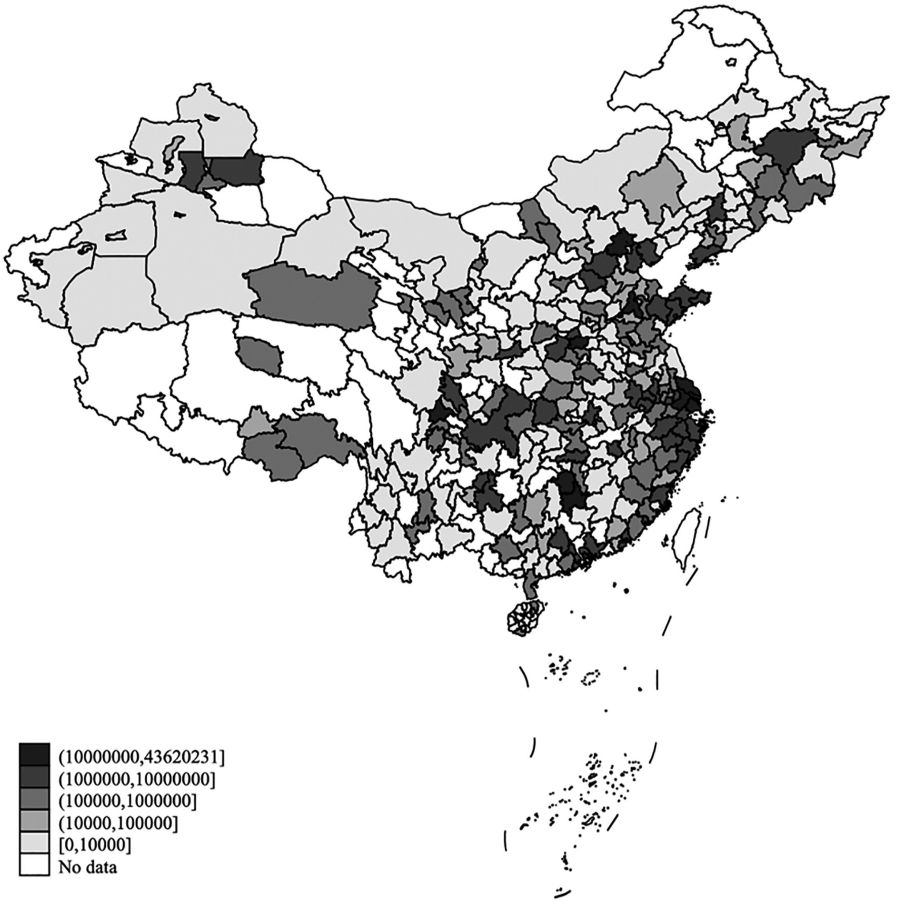
4.4 Business subsidy

We use a novel keyword-based text-mining strategy to extract entries related to the three types of subsidies, from self-disclosed subsidy information aggregated by the CSMAR. The first one is patent subsidy, earmarked to compensate corporations directly for their patenting activities, such as reimbursement of patent application fees or cash awards for successful patent applications or grants. We use two keywords ("patent" and "intellectual property") to identify patent subsidy incomes. Patent subsidy is one of the control variables in testing the relationship between government-business relations and strategic patenting (H1). The second and third are R&D subsidy and industrial policy subsidies, used as dependent variables to examine the effect of strategic patenting on subsidy acquisitions (H3). We use a list of 77 keywords to search for R&D subsidies and 55 keywords for industry policy subsidies [7]. The text-mining method allows us to quantify subsidies instead of relying on dummies for policy changes in previous studies (e.g. Li, 2012; Lei *et al.*, 2012).

On average, each company in our dataset received about RMB 95,391 yuan (or 14,128 US dollars) in patenting-related subsidies in 2017. Figure 3 maps the average amount of patenting-related subsidies per firm in 2017 at prefecture-city level. In general, firms located in the coastal regions receive more patent subsidies, though a few locations in the mid-west of China offer high subsidies as well. Chengdu, for example, is a western Chinese city that has one of the highest levels of patent subsidies.

4.5 Control variables

The model's two main control variables are R&D expenditure and the amount of patent subsidies per firm year. By incorporating R&D and patent subsidies into the model, we can isolate and control the impact of the main patenting drivers identified in previous studies (Hu and Jefferson, 2009, 2014; Li, 2012; Dang and Motohashi, 2015).



Source(s): Compile by authors using subsidy income data obtained from CSMAR

Figure 3.
Average patent subsidy in RMB per firm at prefecture level in 2017

Other control variables include regional economic development level measured as local GDP per capita (Yueh, 2009), R&D intensity that measures firm investment in research activities (Fleming and Sorenson, 2001, 2004), firm age that measures the experience and knowledge of the firms (Kumar and Saqib, 1996; Molero and Buesa, 1996; Kuemmerle, 1998), firm size as a proxy of corporate human resources (Acs and Audretsch, 1987; Cohen and Klepper, 1996; Damanpour, 1992), the type of ownership that affects corporate governance and resource allocation in China (Jefferson *et al.*, 2003; Choi *et al.*, 2011), and differences in patenting propensity by industry (Cohen *et al.*, 2000).

Combining the data from CNRDS, CSMAR and Wind, our analyzing sample consists of 3,756 publicly listed corporations in China. We pair the firm-level patenting and subsidy data with indicators for government-business relations from NADS in 292 Chinese municipalities based on the location of corporation headquarters. The panel data include three time periods: 2017, 2018 and 2020. Table 2 contains a detailed list of the main variables, their descriptions and data sources. Their descriptive statistics are presented in Table 3.

Variable	Description	Data source
Independent variable (H1, H2)		
Government-business Relations Index	A set of indicators measured at prefecture city level, including Closeness Index and Integrity Index, each are constructed from three and two indicator groups, respectively (See Table 1)	NADS
Dependent variable (H1, H2), Independent variable (H3)		
Strategic Patenting	Number of patent filings divided by number of patent grants	CNRDS
Patent filings	Number of patent filings (including all types of patents) with Chinese patent office	CNRDS
Patent grants	Number of patent grants (including all types of patents) with Chinese patent office	CNRDS
Moderator variable (H2)		
Political Connections	Political connection = 1, if an executive or director of the company is serving in a government department; otherwise, 0	CSMAR
Dependent variables (H3)		
R&D subsidies	Estimated from firm-reported subsidy incomes related to R&D activities	CSMAR
Industry policy subsidies	Estimated from firm-reported subsidy incomes related to specific industry policies	CSMAR
Control variables		
Patent subsidies	Estimated from firm-reported subsidy incomes related to patenting activities	CSMAR
R&D	Measured by the share of R&D investment in revenue	Wind
SOE	Ownership type. = 1, if the firm is a state-owned enterprise; otherwise, 0	Wind
Firm Age	Measured by the interval between year of establishment and reporting year	Wind
Firm Size	Measured by the number of employees	Wind
City GDP per capita	GDP per capita in the prefecture city where the firm is located	Wind

Table 2. Variable descriptions

Source(s): Author's own creation

5. Analysis and results

To estimate the effect of local government-business relations on corporate strategic patenting, we use a fixed-effect OLS model in the following specification:

$$SP_{ist} = \alpha_s + \beta G_{st} + X'_{ist}\delta + \varepsilon_{ist}$$

where *i, s,* and *t* index firm, city and year, respectively. SP_{ist} is the *dependent variable* and the indicator of strategic patenting by firm *i* in city *s* at year *t*. The key independent variable, G_{st} is a set of government-business relation measures in city *s* at year *t*. X'_{ist} is a vector of control variables for both time-varying city-level and firm-level characteristics, including R&D investment, patent subsidies, ownership types, firm age, size and local economic development levels in a given year. ε_{ist} are the unobserved determinants of corporate patenting behaviors that are decomposed as follows:

$$\varepsilon_{ist} = \theta_s + \tau_t + \mu_s + \upsilon_{ist}$$

where θ_s is a time-invariant province effect that controls for fixed unmeasured characteristics of provinces. τ_t is a province-invariant year effect that controls for time trends common to all provinces. μ_s is a time-invariant industry-specific time effect that controls for fixed

Variable	Obs	Mean	Std. Dev	Min	Max
Independent variable (H1, H2)					
Government-business Relations Index	869	33.32	16.73	0.00	100.00
Dependent variable (H1, H2), Independent variable (H3)					
Strategic Patenting (Standardized)	11,222	39.38	48.93	0.00	868.00
Patent filings	11,268	40.71	247.36	0.00	11872.00
Patent grants	11,268	48.33	252.94	0.00	10016.00
Moderator variable (H2)					
Political Connections	7,512	0.47	0.50	0.00	1.00
Dependent variables (H3)					
R&D subsidies (logged)	7,512	9.01	7.48	0.00	21.47
Industry policy subsidies (logged)	7,512	9.06	7.39	0.00	20.80
Control variables					
Patent subsidies (logged)	11,268	3.38	5.24	0.00	18.51
R&D	9,979	4.87	6.32	0.00	307.72
SOE	11,268	0.29	0.45	0.00	1.00
Firm Age	11,268	19.21	5.98	1.00	64.00
Firm Size	11,157	5944.50	23155.72	2.00	521566.00
City GDP per capita	761	51071.06	35290.62	9901	215488.00

Note(s): Strategic Patenting (Standardized) = Log (Strategic Patenting+1) *100
Source(s): Author's own creation

Table 3.
Descriptive statistics

unmeasured characteristics of industries, and υ_{ist} is an unobserved error term. Fixed effects are included in the model to reduce estimate bias.

5.1 The effects of government-business relations on strategic patenting

As shown in Table 4, consistent with existing literature, we find both R&D intensity and patent subsidies have positive and significant effects on patenting. This confirms that Chinese corporate patenting is generally correlated with R&D investment and responds to government subsidies. State-owned, more established and larger firms tend to generate more patents, but the level of local economic development does not have a significant effect on patenting.

We find a significant negative relationship between the government-business relations index and the measure of strategic patenting (Model 1), as predicted by H1. Firms located in regions with higher-quality government-business relations engage in strategic patenting to a lesser extent. On average, when the index of government-business relations improves by 1, the number of patent filings per granted patent generated by a firm reduces by 8.84%.

In Model 2, we disaggregate the government-business relations index into sub-indexes of "Closeness" and "Integrity." Only the coefficients of the "Closeness" variable remain significant and negative. In Model 3, we further disaggregate the explanatory variable into five indicators, examining different facets of government-business relations. The result shows the main driving factor of strategic patenting is the "service index" aspect of government-business relations. The service index measures a variety of infrastructure and government services provided to businesses, including transportation infrastructure, financial services, market intermediaries and government services provided through the mobile Internet. It appears that companies in regions with poorer infrastructure, less competent financial sectors, and fewer government service provisions engage to a greater extent in strategic patenting. Indexes measuring government interest in business (the care

Fixed-effect OLS regression	Dependent variable: Firm strategic patenting Model 1	Model 2	Model 3	Model 4
Independent variables				
Gov.-Business Relations Index	−0.0884** (0.037)			−0.128** (0.050)
Closeness Index		−0.110***		
		(0.037)		
Integrity Index		0.0342		
		(0.038)		
Care Index			−0.00427	
			(0.025)	
Service Index			−0.125***	
			(0.037)	
Burden Index			−0.00779	
			(0.032)	
Cleanness Index			0.0454	
			(0.031)	
Transparency Index			0.0154	
			(0.041)	
Moderator variable				
Political Connections (PC)				4.804
				(3.052)
Gov.-Business Relations Index*PC				0.0888* (0.048)
Control variables				
R&D	1.851***	1.851***	1.847***	1.971***
	(0.081)	(0.081)	(0.081)	(0.100)
Patent subsidies (logged)	1.177***	1.172***	1.171***	1.556***
	(0.085)	(0.085)	(0.085)	(0.111)
SOE	4.087***	4.067***	4.094***	5.442***
	(1.042)	(1.042)	(1.043)	(1.340)
Firm Age	0.759***	0.755***	0.755***	0.792***
	(0.077)	(0.077)	(0.077)	(0.100)
Firm Size (logged)	3.878***	3.891***	3.890***	3.588***
	(0.340)	(0.340)	(0.340)	(0.433)
City GDP per capita (logged)	0.160	0.454	1.503	−0.334
	(1.693)	(1.717)	(1.801)	(2.134)
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N. of Obs	10,898	10,898	10,898	7,300
N. of Provinces	31	31	31	31
R-square	0.185	0.186	0.186	0.218

Note(s): Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Author's own creation

Table 4.
The effects of local government-business relations on strategic patenting

index), business tax burden (the burden index), degree of transparency of the government (the transparency index) and the integrity of government officials (the cleanness index) do not appear to have significant effects on strategic patenting. This result is consistent with our theory that more patenting enables firms to address institutional voids with government aid.

5.2 The moderating effect of political connections

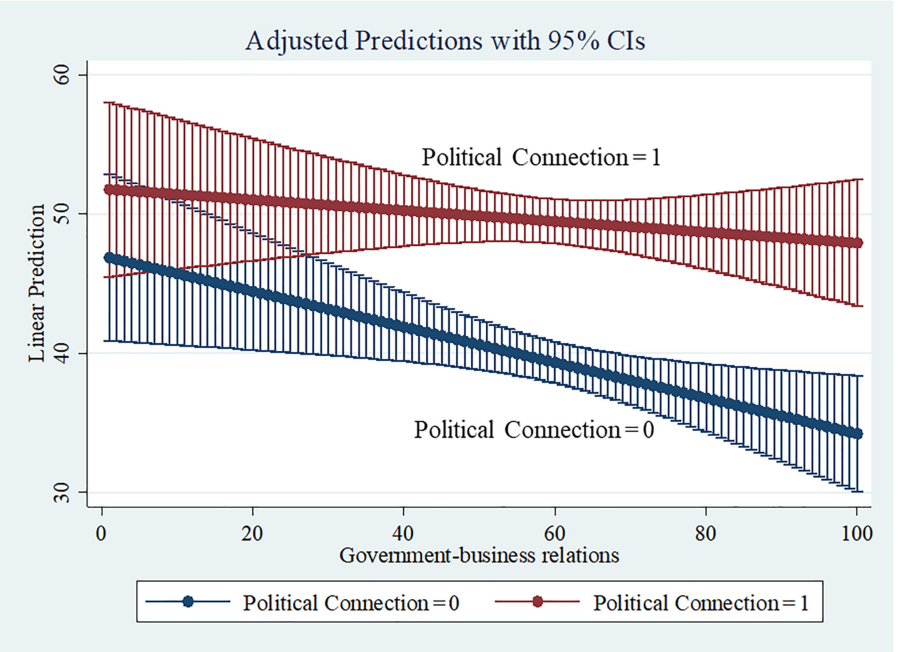
We examine how political connections moderate the impact of government-business relations on strategic patenting. After adding political connections as a moderating variable to Model 1,

we report the findings in Model 4. The result confirms H2 and shows a significant moderating effect, with the interaction term significant at the 95% level. Strategic patenting decreases by 12.8% for every unit increase in the government-business relations index for firms without political connections, while for firms with political connections, strategic patenting is reduced by only 3.92% (i.e. 0.0888–0.128 = −0.0392). Figure 4 shows the moderating effect of political connections at every level of the government-business relations index. Compared to firms with political connections, firms without connections reduce strategic patenting more rapidly as the quality of local government-business relations improves. In other words, the moderating effects of political connections confirm a causal relationship between the motive to influence government and strategic patenting.

5.3 The effects of patenting on acquiring subsidies

We further establish that firms can obtain tangible benefits from strategic patenting by examining the effects of patenting on acquiring additional government subsidies. To avoid reversed causality issues, we use two types of government subsidies that are related to firm innovation activities as dependent variables. And we estimate a lagged effect of patenting on subsidies.

Table 5 presents the estimates of the effect of patenting on the acquisition of R&D and industrial policy subsidies. After controlling for firm and city characteristics as well as fixed effects, the findings indicate that patent filings are highly correlated with R&D and industry policy subsidies the following year ($t + 1$). R&D subsidies are positively correlated with patent filings at a significance level of 99.99% with a coefficient of 0.341 in Model 5. Industry policy subsidies are positively correlated with patent filings at a significance level of 99.99%



Source(s): Author's own creation

Figure 4.
The moderating effect of political connections

Fixed-effect OLS	Model 5 R&D subsidies	Model 6 Industry policy subsidies
Independent variable		
Patent fillings (logged)	0.341***	0.344***
	(0.049)	(0.048)
Control variables		
SOE	−0.324	0.0776
	(0.210)	(0.207)
Firm Age	0.0387**	0.0608***
	(0.016)	(0.016)
Firm Size (logged)	0.247***	0.249***
	(0.070)	(0.069)
City GDP per capita (logged)	−0.316	−0.437*
	(0.257)	(0.254)
Industry FE	Yes	Yes
Province FE	Yes	Yes
Year FE	Yes	Yes
Num. of Observations	7,362	7,362
Num. of Provinces	31	31
R-square	0.020	0.024

Note(s): Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Author's own creation

Table 5.
The effects of patenting on acquiring subsidies

with a coefficient of 0.344 in Model 6. That means, on average, if a firm increases its patent filings by 1%, it will receive 0.341% more R&D subsidies and 0.344% more industry policy subsidies from its local government in the next year, in addition to any patenting-related subsidies the firm might receive. The positive correlation between patent filings and subsequent government subsidies confirms H3, and it further explains the motivations for Chinese firms to patent strategically.

6. Robustness checks

6.1 Alternative measures of strategic patenting

We construct alternative measures of strategic patenting to ensure the reliability of the findings (Table 6). First, since our measurement of strategic patenting is a ratio of patent applications and grants, we take into account the time lag between patent filings and grants, which might bias firms with dramatic change in patenting behaviors. We introduce one- and two-period lags in the number of grants in calculating the ratio. There are no significant changes and the results for one-period lagged indicators are presented in Models R1 – R3. Second, we change the construct from a ratio-based measurement to a quantity-based measure. The total number of patent fillings measures the extent to which strategic patenting inflates patenting in general. Using total patent fillings as the dependent variable, there are no significant changes in the results (Models R4 – R6). Third, we use invention patents filing as an alternative measures. Invention patents have higher value but are difficult to obtain. In the context of this study, invention patents are more valuable networking resources and stronger signals of the firm's innovativeness (Li and Zheng, 2016). We use invention patent filings as the dependent variable, and the overall results remain unchanged (Models R7 – R9). We have also used another Chinese patent database, the Wind-Economic database, as an alternative source of the patenting data, and the results remain unchanged.

Table 6.
Robustness checks

Fixed-effect OLS: Model R1-R3	Model R1	Model R2	Model R3	Model R4	Model R5	Model R6	Model R7	Model R8	Model R9
Fixed-effect negative Binomial: R4 – R9	Patent fillings/ Grants (t+1)	Patent fillings/ Grants (t+1)	Patent fillings/ Grants (t+1)	Total patent filings	Total patent filings	Total patent filings	Invention patent filings	Invention patent filings	Invention patent filings
Independent variables									
Government-Business Relation Index	−0.0657*			−0.00648***			−0.00682***		
	(0.033)			(0.001)			(0.001)		
Closeness Index		−0.0620*			−0.00548***			−0.00653***	
		(0.034)			(0.001)			(0.001)	
Integrity Index		−0.0124			−0.00208***			−0.00114	
		(0.035)			(0.001)			(0.001)	
Care Index			−0.0119			−0.000769			−0.00131**
			(0.023)			(0.001)			(0.001)
Service Index			−0.0686**			−0.00540***			−0.00648***
			(0.034)			(0.001)			(0.001)
Burden Index			0.000620			0.0009			0.00121
			(0.029)			(0.001)			(0.001)
Cleanness Index			0.0424			−0.000801			−0.00146*
			(0.028)			(0.001)			(0.001)
Transparency Index			−0.0319			−0.00210**			−0.000701
			(0.037)			(0.001)			(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of Observations	10,900	10,900	10,900	10,900	10,900	10,900	10,898	10,898	10,898
Num. of Province	31	31	31	31	31	31	31	31	31

Note(s): Standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Source(s): Author's own creation

6.2 Alternative measures of government-business relations

To make sure our results are not biased by the way the NADS Government-Business Relations Index is measured, we use an alternative measure "Business Environment Index of Chinese Cities (*中国城市营商环境指数*)" to re-run the model. This indicator is compiled by the Academy of Greater Bay Area Studies in Shenzhen (Chen *et al.*, 2017, 2018). This series of reports has evaluated the business environments of 35 large cities in China since 2017, including municipalities, sub-provincial cities, and provincial capitals. The business environment index is a good alternative of government-business relations for its following features: 1) It covers evaluations of services and infrastructure provided by the government to businesses, including the enforcement of contracts, corporate tax burden, road area ratio, mobile Internet data facilities, basic infrastructure, medical, and financial services; and 2) It overlaps with the NADS indexes in multiple aspects, but the indexes are compiled by different researchers with different methodologies. We collect the business environment indexes for 35 cities in two consecutive years, from 2017 to 2018, and pair them with the corporate samples in our database to obtain a total sample of 2,183 firms. We then regress the business environment index on strategic patenting measures using the sample model specification in Model 1. The result is consistent with Model 1, where the business environment index also has a significant and negative effect on strategic patenting. Control variables, including patent subsidies, SOE, firm age, and firm size, all have significant and positive effects, while city GDP per capita remains insignificant.

In addition, to prevent the results from being driven by outliers, we drop firms older than 40 years or larger than 10,000 employees. We lose 398 samples, but the significance and direction of the main regressions remain unchanged. We also used prefecture-level city fixed effects instead of provincial fixed effects in the model to eliminate possible exit mechanisms, and the results remained robust [8].

7. Conclusions and discussions

7.1 Major findings

In this study, we explore the motivations of Chinese companies to engage in strategic patenting by empirically testing the relationship between local government-business relations and corporate patenting. Three main findings are worthy of note. To begin with, we find that R&D investment and patent subsidies drive corporate patenting in China only to an extent, rendering updated evidence in support of previous studies on China's patenting boom (Dang and Motohashi, 2015; Hu and Jefferson, 2009; Li, 2012). We show there is a negative relationship between local government-business relations and strategic patenting behaviors; that is, firms located in poorly governed regions have stronger motivations to fill more lower-quality patent applications per successful grant. We infer such motivations to patent as "strategic patenting," because they diverge from patenting to protect genuine innovation outcomes. In the context of emerging markets, Chinese firms that engage in strategic patenting are motivated by the need to influence local governments that are responsible for promoting innovation and development.

Second, we find evidence of a moderating effect of political connections on the impact of government-business relations. Compared to firms with political connections, measured as having executives holding official posts, firms without connections are more sensitive to the quality of local government-business relations in their strategic patenting behaviors. When the quality of local government-business relations improves, firms without political connections reduce strategic patenting more rapidly than those with connections. The moderating effect of political connections shows that the relationship between government-business relations and strategic patenting is likely causal. It also shows that strategic patenting can substitute for *guanxi*, as Chinese local governments put emphasis on technological innovations.

Finally, we find that strategic patenting yields tangible benefits in the form of additional government subsidies in subsequent years. This result confirms our hypothesis that patenting serves as a signaling mechanism to demonstrate the firm's innovativeness to local governments, which often lack the capacity to identify potential innovators when implementing industrial policy. We cannot rule out the possibility that some of these subsidies are rewards for boosting metrics of innovation performance for local officials. Nevertheless, in both cases, strategic patenting allows firms to influence local industrial policy and acquire resources for innovation.

7.2 Theoretical and practical implications

The findings of this paper expand our understanding of China's patent boom. Our results offer a new institutional perspective for understanding corporate strategic patenting behaviors in China. In contrast to the widely held belief that corporate patenting in China is simply a response to government subsidies, our results suggest that the patent boom in China is partially driven by the strategic intention of networking and signaling to the government, with the potential benefits from government recognition that may offset weaknesses in local institutions. Thus, we add empirical evidence to the institutional economics literature, which has long emphasized a tacit alliance between Chinese firms and local governments in pursuit of innovation strategies (Breznitz and Murphree, 2011; Tang *et al.*, 2016). In this regard, we contribute to a better understanding of the persistent gap between the patent boom and underlying technological progress as a result of China's political economy.

Our research expands the analysis of strategic patenting to the study of emerging markets. Strategic patenting has been previously regarded as a phenomenon in developed markets with strong intellectual property protection schemes (Farrell and Shapiro, 2008; Noel and Schankerman, 2013; Hall and Ziedonis, 2001; Ziedonis, 2004). Our study combines insights from the theory of institutional voids to show that strategic patenting can serve a unique function in emerging markets, thus extending our understanding of both strategic patenting and the institutional arrangements in emerging markets. We encourage future research to investigate how unique local institutions constrain and transform innovation behaviors in emerging markets by bridging the studies of innovation and emerging markets.

Some policy implications from this study are worthy of note. On January 27, 2021, the China National Intellectual Property Administration (CNIPA) announced an end to all patent subsidies by 2025 [9]. Our analysis suggests that rolling back patent subsidies will reduce patenting for non-innovation purposes to a limited extent. As long as strategic patenting serves a particular function of networking and signaling in China's local political economy, we expect such a practice will persist while China emphasizes technological innovation in its official evaluations. Despite its persistence, strategic patent filings may waste valuable resources, distorts information in the market for technology, and ultimately harms the firm's innovation capabilities. To reduce inflated patenting, the Chinese local government will have to do more than roll back subsidies. Our study suggests that the local government needs to increase its capacity to design and implement industrial policy and provide market-based opportunities for firms to access innovation inputs.

7.3 Limitations

We acknowledge the limitations of our research and call for future research to better address them. We are limited by computer capabilities to process the Chinese language when constructing measurements. Future advances in text-mining techniques that make use of the full text of Chinese patent documents will generate fine-grained measurements of strategic patenting. We also have limitations in the scope and coverage of our sample by relying on secondary data. Collecting more comprehensive data including a first-hand survey and in-depth interviews promises the potential for a more rigorous examination of our hypotheses.

7.4 Conclusion

This study explores how China's patent boom is partially driven by the firm's motives to patent strategically and influence the local government, which is responsible for promoting industry and innovation. Drawing on a dataset of publicly-listed firms paired with surveys of Chinese municipalities, we find a negative relationship between strategic patenting and government-business relations, moderated by the firm's political connections. We also find evidence of the benefits of strategic patenting in the form of additional subsidies in the years following. By extending the analysis of factors contributing to China's patent boom, we advance our understanding of how strategic patenting can be shaped by institutions in emerging markets.

Notes

1. Source: https://www.wipo.int/portal/en/index.html
2. SIPO stands for the State Intellectual Property Office of China. SIPO was renamed to the China National Intellectual Property Administration (CNIPA) in September 2018.
3. The Organization Department of the Central Commission. (2013), "Notice on Improving the Performance Evaluation of Local Cadres", available at: http://cpc.people.com.cn/GB/67481/94156/372307/index.html (accessed 30 January, 2023).
4. The Central Committee of the Communist Party of China and the State Council. (2015), "Several Opinions on Deepening the Reform of institutional mechanisms and Accelerating the Implementation of the strategy of innovation-driven development", available at: http://www.gov.cn/xinwen/2015-03/23/content_2837629.htm (accessed 30 January, 2023).
5. General Office, the People's Government of Guangdong Province. (2016), "Implementation Measures for the Evaluation of Innovation-Driven Development Performance in Guangdong Province", available at: http://www.gd.gov.cn/gkmlpt/content/0/144/mpost_144654.html#7 (accessed 30 January, 2023).
6. We use a broad definition of "official positions," which includes not only positions at all levels of the communist party and government agencies but also positions in the National People's Congress, the National Committee of the Chinese People's Political Consultative Conference, non-communist parties, social organizations, and colleges and universities, which may serve as channels with the local government.
7. R&D subsidies include various subsidy incomes firms receive for conducting corporate R&D activities in a broad sense, including technological transformation, key technology development, and the acquisition of research personnel. Industry policy subsidies refer to firm subsidy income related to policies targeting the development of specific industries (i.e. industrial policy), including subsidies for emerging industries, medium-sized and small enterprises, leading enterprises, and so on. A detailed list of keywords (in Chinese) used in the search strategy is available from the authors upon request.
8. These additional estimates of robustness results are available upon request to the authors.
9. China National Intellectual Property Administration. (2021), "Notice of the CNIPA on Further Strictly Regulating Patent Application Behavior", available at: https://www.cnipa.gov.cn/art/2021/1/27/art_545_156433.html?xxgkhide=1 (accessed 23 February, 2021)

References

Acs, Z.J. and Audretsch, D.B. (1987), "Innovation, market structure, and firm size", *The Review of Economics and Statistics*, Vol. 69 No. 4, pp. 567-574.

Banerji, A., Cull, R.J., Demirguc-Kunt, A., Djankov, S., Dyck, A., Islam, R., Kraay, A.C., Mcliesh, C. and Pittman, R.W. (2002), "World development report 2002: building institutions for markets (English)", World Development Report, World Bank Group, Washington, DC.

Boeing, P. and Mueller, E. (2016), "Measuring patent quality in cross-country comparison", *Economics Letters*, Vol. 149 No. 1, pp. 145-147.

Breznitz, D. and Murphree, M. (2011), *The Run of the Red Queen: Government, Innovation, Globalization, and Economic Growth in China*, Yale University Press, New Haven, CT.

Cantwell, J., Dunning, J.H. and Lundan, S.M. (2010), "An evolutionary approach to understanding international business activity: the co-evolution of MNEs and the institutional environment", *Journal of International Business Studies*, Vol. 41 No. 4, pp. 567-586.

Caulfield, J.L. (2006), "Local government reform in China: a rational actor perspective", *International Review of Administrative Sciences*, Vol. 72 No. 2, pp. 253-267.

Chan, K.S., Xu, X. and Gao, Y. (2015), "The China growth miracle: the role of the formal and the informal institutions", *The World Economy*, Vol. 38 No. 1, pp. 63-90.

Chen, C., Geng, Y., Huang, L., Zhang, H., Ding, J., Li, G., Yao, J. and Dai, C. (2017), "Business environment index of Chinese cities 2017", Guangdong Academy of Greater Bay Area Studies, 21st Century Economic Institute, available at: http://www.gigba.org.cn (accessed 30 January 2023).

Chen, C., Geng, Y., Huang, L., Ding, J., Nian, K. and Deng, J. (2018), "Business environment index of Chinese cities 2018, business environment index of Chinese cities 2017", Guangdong Academy of Greater Bay Area Studies, 21st Century Economic Institute, available at: http://www.gigba.org.cn (accessed 30 January 2023).

Chen, Z., Liu, Z., Suárez Serrato, J.C. and Xu, D.Y. (2021), "Notching R&D investment with corporate income tax cuts in China", *American Economic Review*, Vol. 111 No. 7, pp. 2065-2100.

Choi, S.B., Lee, S.H. and Williams, C. (2011), "Ownership and firm innovation in a transition economy: evidence from China", *Research Policy*, Vol. 40 No. 3, pp. 441-452.

Cohen, W.M. and Klepper, S. (1996), "Firm size and the nature of innovation within industries: the case of process and product R&D", *The Review of Economics and Statistics*, Vol. 78 No. 2, pp. 232-243.

Cohen, W.M., Nelson, R. and Walsh, J.P. (2000), *Protecting Their Intellectual Assets: Appropriability Conditions and Why US Manufacturing Firms Patent (Or Not)*, National Bureau of Economic Research Cambridge, Massachusetts.

Damanpour, F. (1992), "Organizational size and innovation", *Organization Studies*, Vol. 13 No. 3, pp. 375-402.

Dang, J. and Motohashi, K. (2015), "Patent statistics: a good indicator for innovation in China? Patent subsidy program impacts on patent quality", *China Economic Review*, Vol. 35, pp. 137-155.

DiMaggio, P.J. and Powell, W.W. (1983), "The iron cage revisited: institutional isomorphism and collective rationality in organizational fields", *American Sociological Review*, Vol. 48 No. 2, pp. 147-160.

Doh, J., Rodrigues, S., Saka-Helmhout, A. and Makhija, M. (2017), "International business responses to institutional voids", *Journal of International Business Studies*, Vol. 48 No. 3, pp. 293-307.

Farrell, J. and Shapiro, C. (2008), "How strong are weak patents?", *American Economic Review*, Vol. 98 No. 4, pp. 1347-1369.

Feng, K. and Jiang, Z. (2021), "State capacity in China's innovation subsidy policy", *China Review*, Vol. 21 No. 3, pp. 89-122.

Fleming, L. and Sorenson, O. (2001), "Technology as a complex adaptive system: evidence from patent data", *Research Policy*, Vol. 30 No. 7, pp. 1019-1039.

Fleming, L. and Sorenson, O. (2004), "Science as a map in technological search", *Strategic Management Journal*, Vol. 25 Nos 8-9, pp. 909-928.

Funk, R.J. and Hirschman, D. (2017), "Beyond nonmarket strategy: market actions as corporate political activity", *Academy of Management Review*, Vol. 42 No. 1, pp. 32-52.

Ge, J., Carney, M. and Kellermanns, F. (2019), "Who fills institutional voids? Entrepreneurs' utilization of political and family ties in emerging markets", *Entrepreneurship Theory and Practice*, Vol. 43 No. 6, pp. 1124-1147.

Hall, B.H. and Ziedonis, R.H. (2001), "The patent paradox revisited: an empirical study of patenting in the US semiconductor industry, 1979-1995", *Rand Journal of Economics*, Vol. 32 No. 1, pp. 101-128.

Hu, A.G. and Jefferson, G.H. (2009), "A great wall of patents: what is behind China's recent patent explosion?", *Journal of Development Economics*, Vol. 90 No. 1, pp. 57-68.

Hu, A.G. and Jefferson, G.H. (2014), "Propensity to patent, competition and China's foreign patenting surge", in Ahn, S., Hall, B.H. and Lee, K. (Eds), *Intellectual Property for Economic Development*, Edward Elgar Publishing, pp. 264-286.

Hu, A.G., Zhang, P. and Zhao, L. (2017), "China as number one? Evidence from China's most recent patenting surge", *Journal of Development Economics*, Vol. 124, pp. 107-119.

Huang, P.C. (2011), "The theoretical and practical implications of China's development experience: the role of informal economic practices", *Modern China*, Vol. 37 No. 1, pp. 3-43.

Jefferson, G., Hu, A.G., Guan, X. and Xiaoyun, Y. (2003), "Ownership, performance, and innovation in China's large-and medium-size industrial enterprise sector", *China Economic Review*, Vol. 14 No. 1, pp. 89-113.

Khan, B.Z. (2005), *The Democratization of Invention: Patents and Copyrights in American Economic Development, 1790-1920*, Cambridge University Press, New York, NY.

Khanna, T. and Palepu, K. (1997), "Why focused strategies", *Harvard Business Review*, Vol. 75 No. 4, pp. 41-51.

Khanna, T. and Rivkin, J.W. (2001), "Estimating the performance effects of business groups in emerging markets", *Strategic Management Journal*, Vol. 22 No. 1, pp. 45-74.

Kuemmerle, W. (1998), "Optimal scale for research and development in foreign environments—an investigation into size and performance of research and development laboratories abroad", *Research Policy*, Vol. 27 No. 2, pp. 111-126.

Kumar, N. and Saqib, M. (1996), "Firm size, opportunities for adaptation and in-house R&D activity in developing countries: the case of Indian manufacturing", *Research Policy*, Vol. 25 No. 5, pp. 713-722.

Lei, Z., Sun, Z. and Wright, B. (2012), *Patent Subsidy and Patent Filing in China"*, University of California, Berkeley.

Li, X. (2012), "Behind the recent surge of Chinese patenting: an institutional view", *Research Policy*, Vol. 41 No. 1, pp. 236-249.

Li, Y. (2022), *China's Drive for the Technology Frontier: Indigenous Innovation in the High-Tech Industry*, Routledge, London.

Li, W. and Zheng, M. (2016), "Substantive innovation or strategic innovation: the impact of macro-industrial policy on micro-enterprise innovation", *Economic Research*, Vol. 51 No. 4, pp. 60-73, in Chinese.

Li, Y., Youtie, J. and Shapira, P. (2015), "Why do technology firms publish scientific papers? The strategic use of science by small and midsize enterprises in nanotechnology", *The Journal of Technology Transfer*, Vol. 40 No. 6, pp. 1016-1033.

Liang, M. (2012), "Chinese patent quality: running the numbers and possible remedies", *John Marshall Review of Intellectual Property Law*, Vol. 11, pp. 478-522.

Lin, H., Zeng, S.X., Ma, H.Y., Qi, G.Y. and Tam, V.W.Y. (2014), "Can political capital drive corporate green innovation? Lessons from China", *Journal of Cleaner Production*, Vol. 64 No. 1, pp. 63-72.

Lin, J., Wu, H.M. and Wu, H. (2021), "Could government lead the way? Evaluation of China's patent subsidy policy on patent quality", *China Economic Review*, Vol. 69, 101663.

Manolova, T.S., Edelman, L.F., Shirokova, G. and Tsukanova, T. (2019), "Youth entrepreneurship in emerging economies: can family support help navigate institutional voids?", *Journal of East-West Business*, Vol. 25 No. 4, pp. 363-395.

Ministry of Science and Technology of the People's Republic of China, Ministry of Finance of the People's Republic of China and State Taxation Administration of The People's Republic of China (2008), "The administrative measures for determination of high and new technology enterprises", (issued 28 April 2008), available at: https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fgzc/gfxwj/gfxwj2010before/200811/t20081129_65744.html (accessed 30 January 2023).

Molero, J. and Buesa, M. (1996), "Patterns of technological change among Spanish innovative firms: the case of the Madrid region", *Research Policy*, Vol. 25 No. 4, pp. 647-663.

Montinola, G., Qian, Y. and Weingast, B.R. (1995), "Federalism, Chinese style: the political basis for economic success in China", *World Politics*, Vol. 48 No. 1, pp. 50-81.

Murphree, M., Tang, L. and Breznitz, D. (2016), "Tacit local alliance and SME innovation in China", *International Journal of Innovation and Regional Development*, Vol. 7 No. 3, pp. 184-202.

Nie, H., Han, D., Ma, L. and Zhang, N. (2018), "Chinese city rankings on government-business relations 2017", National Academy of Development and Strategy (NADS) at the Renmin University of China, available at: http://nads.ruc.edu.cn/zkcg/ndyjbg/c9ad75 bec3024ec0bb24e4fc6b7d3c14.htm, (accessed 30 January, 2023).

Nie, H., Han, D., Ma, L. and Zhang, N. (2019), "Chinese city rankings on government-business relations 2018", National Academy of Development and Strategy (NADS) at the Renmin University of China, available at: http://nads.ruc.edu.cn/zkcg/ndyjbg/1031da3ad5a846e39111bb4bcd84fe81.htm (accessed 30 January 2023).

Nie, H., Han, D., Ma, L. and Zhang, N. (2020), "Chinese city rankings on government-business relations 2020", National Academy of Development and Strategy (NADS) at the Renmin University of China, available at: http://nads.ruc.edu.cn/zkcg/ndyjbg/3d654f89be5e4f618f004e37264aedfb.htm (accessed 30 January 2023).

Noel, M. and Schankerman, M. (2013), "Strategic patenting and software innovation", *The Journal of Industrial Economics*, Vol. 61 No. 3, pp. 481-520.

Peng, M.W. (2003), "Institutional transitions and strategic choices", *Academy of Management Review*, Vol. 28 No. 2, pp. 275-296.

Shen, Y., Huang, H. and Zhao, L. (2018), "Local government R&D worship and enterprise patent bubbles", *Science Research Management*, Vol. 39 No. 4, pp. 83-91.

Sliwka, D. (2007), "Trust as a signal of a social norm and the hidden costs of incentive schemes", *American Economic Review*, Vol. 97 No. 3, pp. 999-1012.

Spence, M. (2002), "Signaling in retrospect and the informational structure of markets", *American Economic Review*, Vol. 92 No. 3, pp. 434-459.

Squicciarini, M., Dernis, H. and Criscuolo, C. (2013), "Measuring patent quality: indicators of technological and economic value", OECD Science, Technology and Industry Working Papers, No. 2013/03, OECD Publishing, Paris.

Su, W., Peng, M.W., Tan, W. and Cheung, Y.L. (2016), "The signaling effect of corporate social responsibility in emerging economies", *Journal of Business Ethics*, Vol. 134 No. 3, pp. 479-491.

Su, Z., Xiao, Z. and Yu, L. (2019), "Do political connections enhance or impede corporate innovation?", *International Review of Economics and Finance*, Vol. 63 No. 1, pp. 94-110.

Sydow, A., Cannatelli, B.L., Giudici, A. and Molteni, M. (2022), "Entrepreneurial workaround practices in severe institutional voids: evidence from Kenya", *Entrepreneurship Theory and Practice*, Vol. 46 No. 2, pp. 331-367.

Tang, L., Murphree, M. and Breznitz, D. (2016), "Structured Uncertainty: a pilot study on innovation in China's mobile phone handset industry", *Journal of Technology Transfer*, Vol. 41 No. 5, pp. 1168-1194.

Teets, J.C., Hasmath, R. and Lewis, R.A. (2017), "The incentive to innovate? The behavior of local policymakers in China", *Journal of Chinese Political Science*, Vol. 22 No. 4, pp. 505-517.

The Central Committee of the Communist Party of China and the State Council (2015), "Several Opinions on deepening the reform of institutional mechanisms and accelerating the implementation of the strategy of innovation-driven development", (issued 3 Mar 2015) available at: http://www.gov.cn/xinwen/2015-03/23/content_2837629. htm (accessed 30 January 2023).

The Organization Department of the Central Commission (2013), "Notice on improving the performance evaluation of local cadres", (issued 6 Dec 2013) available at: http://cpc.people.com.cn/GB/67481/94156/372307/index.html (accessed 30 January 2023).

Tsai, K.S. (2006), "Adaptive informal institutions and endogenous institutional change in China", *World Politics*, Vol. 59 No. 1, pp. 116-141.

Tsai, K.S. (2007), *Capitalism without Democracy*, 1st ed., Cornell University Press, Ithaca, NY.

Wang, D., Cui, L., Vu, T. and Feng, T. (2022), "Political capital and MNE responses to institutional voids: the case of Chinese state-owned enterprises in Africa", *Organization Studies*, Vol. 43 No. 1, pp. 105-126.

Wei, S.J., Xie, Z. and Zhang, X. (2017), "From 'Made in China' to 'Innovated in China': necessity, prospect, and challenges", *Journal of Economic Perspectives*, Vol. 31 No. 1, pp. 49-70.

Wright, B.D. (1983), "The economics of invention incentives: patents, prizes, and research contracts", *American Economic Review*, Vol. 73 No. 4, pp. 691-707.

Xu, C. (2011), "The fundamental institutions of China's reforms and development", *Journal of Economic Literature*, Vol. 49 No. 4, pp. 1076-1151.

Yueh, L. (2009), "Patent laws and innovation in China", *International Review of Law and Economics*, Vol. 29 No. 4, pp. 304-313.

Zhang, H., Li, L., Zhou, D. and Zhou, P. (2014), "Political connections, government subsidies and firm financial performance: evidence from renewable energy manufacturing in China", *Renewable Energy*, Vol. 63 No. 1, pp. 330-336.

Ziedonis, R.H. (2004), "Don't fence me in: fragmented markets for technology and the patent acquisition strategies of firms", *Management Science*, Vol. 50 No. 6, pp. 804-820.

Corresponding author
Yin Li can be contacted at: yinli@fudan.edu.cn