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Nonmonetary Awards and Innovation: Evidence from Winning China's Top Brand Contest

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Abstract

We use the short-lived, but high-profile, China Top Brand Award to examine the causal effects of nonmonetary awards on firm innovation. To do so, we create a panel dataset by matching official China Top Brand Award recipients to the innovation outputs of listed companies. Results from difference-in-differences estimates show that firms that received the China Top Brand Award have a higher number, and better quality, of filed patents. We find that the positive effects of winning the China Top Brand Award on innovation outputs operate through higher government subsidies to winning firms. We also find that the positive effects of award-winning are stronger among state-owned enterprises, larger enterprises, and better-performing enterprises, as well as in provinces with stronger intellectual property rights protection. Our results are robust to a series of sensitivity checks.

Keywords: China Top Brand Award; intellectual property rights; innovation outputs

JEL Codes: M2; O3

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1. Introduction

Frey (2006: 377) suggests that ‘if an alien were to look at the social life of people here on earth, it would be stunned by the enormous number of awards in the form of orders, medals, decorations, prizes, titles, and other honors’. Governments routinely bestow numerous nonmonetary symbolic awards on individuals and organisations. Situating our contribution in the literature on awards as signals (see, Frey, 2006, 2007; Frey & Gallus, 2017b; Frey & Neckermann, 2008, 2009c; Gallus & Frey, 2016; Neckermann & Frey, 2013), we examine whether, and how, winning an award causes an increase in innovation outputs. Most of the existing literature on awards as signals focuses on individuals (Frey, 2006, 2007; Frey & Gallus, 2017a; Frey & Gallus, 2017b; Frey & Neckermann, 2008, 2009c; Gallus & Frey, 2016; Neckermann & Frey, 2013). With few exceptions, such as Moser and Nicholas (2013), relatively little attention has been given to studying the effects of the role of official awards on changing organisational outcomes. Most of the existing literature focuses on the effect of monetary compensation on award winners. Again, with few exceptions, such as Fontana *et al.* (2013) and Moser and Nicholas (2013), there is little research on the role that nonmonetary awards play in altering behaviour. Finally, most of the awards as signals literature do not examine the mechanisms through which awards affect outcomes.

We examine the causal effects of winning the China Top Brand Contest, an influential official brand endorsement scheme in China that operated between 2001 and 2007, on organisational innovation outputs. We also examine a series of channels and moderators through which the Top Brand Contest affected organisational outcomes. A particular feature of the China Top Brand Contest is that there was no direct monetary reward, such as a cash prize, for winning the competition. Rather, the China Top Brand Contest permitted winning firms to affix the China Top Brand logo on their products and marketing materials in order to signal that their superior quality was endorsed by the central government. In addition, China Top Brand Award products received an exemption from routine and random quality checks conducted by government agencies at all levels.

The contest emphasised the importance of independent intellectual property rights and core technologies in the evaluation process. This criterion aimed to encourage companies to invest in research and development (R&D) activities, fostering technological advancements and overall progress in the industry. By studying the causal effects of winning the China Top Brand Contest on organisational innovation outputs, we can gain insights into how this endorsement scheme influenced firms’ performance and innovation capabilities during its operation. Winning firms might be motivated to invest more in R&D to maintain and improve their product quality, as well as to innovate and develop new technologies. This could lead to a positive impact on organisational innovation outputs, such as the introduction of new and improved products, patents, or other technological advancements.

A challenge with examining the effect of winning the Top Brand Contest on innovation is that winning the contest is likely endogenous given that firms with a higher level of innovation outputs are more likely to apply for, and win, the China Top Brand Award; thus, biasing the estimate upwards. To address this issue, we employ a difference-in-differences (DiD) model to estimate the average treatment effect of winning the China Top Brand Award since some firms have won the China Top Brand awards while others have not. We find that winning the China Top Brand Award has a positive effect on the number, and quality, of innovation outputs. We find that the positive effects of winning the China Top Brand Award on innovation outputs are channelled through the allocation of higher government R&D subsidies to firms that received the Award. We also find that the positive effects of winning the Award are stronger among state-owned enterprises, larger enterprises and better-performing enterprises, as well as in provinces with stronger intellectual property rights protection.

We extend a series of studies that have examined the effect of winning innovation prizes on incentives to invest in R&D (Graff Zivin & Lyons, 2021; Nalebuff & Stiglitz, 1983; Rogerson, 1989; Wright, 1983). We differ from

these studies in that their focus is on how a compensation scheme (i.e., monetary prizes) affects innovation, while our focus is on how awards that provide nonmonetary honours influence innovation.

We also contribute to a literature that has examined how nonmonetary awards affect innovation. Much of this literature has been by economic historians of technology, focusing on historical competitions. For example, Moser and Nicholas (2013) study the effect of winning awards at the Crystal Palace Exhibition in 1851 on subsequent innovation. Other studies that have used more contemporary datasets, such as Fontana *et al.* (2013), have been more exploratory in nature and, as such, have not focused on establishing causation, which is important for formulating policy. We differ from these studies in that we examine the effect of a recent innovation prize that provides a nonmonetary award on innovation and pay close attention to causation.

Our contribution is also related to the literature on innovation contests more generally (Adamczyk *et al.*, 2012; Caird, 1994; Larsen & Lewis, 2007; Makkonen & Inkinen, 2014; Terwiesch & Xu, 2008). We differ from this literature in that innovation contests are established with the direct purpose of either stimulating innovation and generating new ideas (*ex ante* prizes) or rewarding past innovative performance (*ex post* prizes) (Adamczyk *et al.*, 2012). Our focus is on a more general scheme that was established to increase product quality. We examine how ‘abundant but neglected’ business awards act as incentives for innovation (Frey & Neckermann, 2009a).

We contribute to the literature on the signalling role of awards and how awards influence firm behaviours and outcomes. An emerging stream of literature has started to examine how firms create and capture value from business excellence awards via increased visibility, legitimacy and trustworthiness (Cetindamar & Kilitcioglu, 2013; English, 2005; Hashim *et al.*, 2021; Swaffin-Smith & Jebb, 2000; Yoo & Pae, 2016). Past studies suggest that award-winning firms can capture symbolic gains (see, Bovaird & Löffler, 2009, for a review); improve brand identity and company profile (Jones *et al.*, 2014); increase sales and customer satisfaction (Lasrado, 2017); as well as boost productivity (Iyer *et al.*, 2013). Nonetheless, recent studies provide mixed findings on the effects of awards on a firm’s market value. For example, firms that won green awards saw adverse effects on their share value (Fisher-Vanden & Thorburn, 2011; Jacobs *et al.*, 2010; Kim & Lyon, 2015; Lyon *et al.*, 2013). Zhang *et al.* (2021) find that winning the China Quality Award does not affect stock returns in the short term, although it can bring some positive benefits to firms in the long run. Yet none of these studies examines the effect of awards on innovation. In sum, Asante *et al.* (2022) suggest that there is a lack of understanding of the potential benefit of awards or ‘their nuanced impact on competitiveness and, simply, why many organisations are keen to put their hats in the ring to compete for these [awards] (Frey & Neckermann, 2008; Wang & Tsai, 2014; Yap & Webber, 2015)’.

A gap in the literature on how awards influence firm behaviour and outcomes is the lack of evidence for China or other post-socialist transition economies. The role of awards in signalling is likely to be particularly apt when there are information asymmetries between principal and agent (Gallus & Frey, 2016). Information asymmetries and policy uncertainty are likely to be particularly acute in post-socialist economies, reflecting that such economies are between plan and market (Byrd, 1989). In such economies, there is an added role for state intervention and the various state actors, such as the state-owned banks and government agencies, typically look for government signals when deciding how to allocate lending and subsidies to conform with the state’s wishes. Under these circumstances, there is added potential for discretionary awards, such as the China Top Brand Award, to serve as a mechanism for the government, as principal, to signal to its agencies how it wants them to direct funding. This suggests that awards may play a particularly important role in connecting funding allocation with innovation in such economies.

The gap in our understanding of how awards might influence innovation in China is particularly important, given the increased focus on innovation among Chinese enterprises and the reasons for it (see, e.g., Prud’homme & Von Zedtwitz, 2018). In 2019, China filed 1.4 million patents, or 43.4 per cent of the world’s total patent applications,

which was more than double the number of patent filings in the United States (World Intellectual Property Organization, 2020). China also surpassed the United States in 2019 to become the leading country in terms of international patent applications under the Patent Cooperation Treaty (World Intellectual Property Organization, 2020). We contribute to the debate on why Chinese firms innovate and which Chinese firms innovate (Abrami *et al.*, 2014a; Abrami *et al.*, 2014b; Fuller, 2016), as well as the bigger picture question of why China has led the world in terms of the number of patent filings since 2011 (World Intellectual Property Organization, 2020). More generally, we contribute to a better understanding of ‘China’s innovation challenge’ in the process of overcoming the middle-income trap (Lewin *et al.*, 2016). In particular, we contribute to a better understanding of how in China ‘the adoption of market mechanisms for organizing economic activity has become acceptable particularly when integrated with *government-driven* economic or social initiatives’ (Lewin *et al.*, 2016: 5).

The existing literature offers a few explanations for why China has such a large number of patent applications (see, e.g., Lewin *et al.*, 2016). One explanation is that political endorsement, as exemplified in a firm’s ownership structure, impacts a firm’s investment in innovation. While some studies suggest that state ownership makes the firm less efficient in producing innovation outputs (Yang *et al.*, 2019; Zhou *et al.*, 2017), other studies find that a higher share of state ownership within a firm is associated with higher innovation quality (Cao *et al.*, 2020; Teng & Yi, 2017; Wang *et al.*, 2022). A related stream of literature examines the relationship between political connections and firm innovation. For instance, a firm’s political connection, defined by whether the chairperson or CEO of a listed company is a former or current highly-ranked government official or a current member of one of the national legislative-making organs, is positively associated with innovation quantity, but negatively associated with innovation quality (Liu *et al.*, 2021). Yet, while state ownership or political connections can explain some variations in innovation quantity and quality, most Chinese firms are private-controlled (nearly 20 million), compared to only 266,000 state-controlled firms. Based on the data used in the present study for listed companies in China, more than half do not have any state shares, and only approximately 40 per cent of them have any political connection. Thus, the findings from the above studies are not apposite to the vast majority of firms filing patents in China.

Another explanation offered for China’s emergence as the global patent powerhouse is that it is the result of the Chinese government policy that incentivises the quantity of patents and supports this via government subsidies. In this respect, it is often argued that most of China’s patent applications stem from motives other than innovation, such as seeking government subsidies, building a reputation for individuals or organisations, or acquiring certification as national high-tech enterprises, which are linked to preferential government treatment (Huang *et al.*, 2017; Prud’homme & Zhang, 2019). This explanation is consistent with the prevalent view that firms pursue low-quality innovation in order to attract government subsidies rather than to maximise returns to technological advances (Dang & Motohashi, 2015; Kleer, 2010). However, other studies find that China’s patent subsidy policies have improved both the quantity and quality of patents (Fisch *et al.*, 2016; Lin *et al.*, 2021).

We offer an alternative explanation, which is that the state’s explicit brand endorsement is as an important factor contributing to China’s rapid growth in innovation outputs. While the China Top Brand Award only ran from 2001 to 2007 and, hence, in itself, cannot be responsible for the rapid subsequent growth in firm innovation outputs, the China Top Brand Award has spawned a number of similar schemes (Fan, 2007; Lyon *et al.*, 2013). Multiple official brand and business award contests and schemes are currently in operation at the national, provincial, prefecture and even county levels.¹ Frey and Neckermann (2009b) find that Chinese business people

¹ Some of the largest national business awards and competitions include, for example, the China Quality Award organised by the China Association for Quality, the China Innovation and Entrepreneurship Competition and the National Technology Incubator Scheme organised by the Ministry of Science and Technology, the China Time-honoured Brands awards organised by the Ministry of Commerce, the China Quality Award organised by the China Association for Quality, and the People’s Corporate Social

listed in the *International Who's Who* received even more business awards than those from the United States, where business awards are among the most prevalent in the developed world. Our findings are suggestive that such awards may be important in helping to understand why Chinese firms file so many patents.

2. Overview of the China Top Brand Award

China's intellectual property regime has made significant strides since 1984, prior to which it had no patent law. China revised its patent law as part of its accession into the World Trade Organization in 2001 as a significant step toward compliance with international standards. Against this background, the China Top Brand Contest, which was first held in 2001, sought to promote 'self-reliant innovation capacity and product quality by proactively protecting a selected group of products amid rampant intellectual property rights violations and counterfeits, according to the General Administration of Quality Supervision, Inspection and Quarantine (GAQSIQ) (2006).

In the China Top Brand Contest, firms submitted their applications to an award selection committee under the administration of GAQSIQ. This committee consists of sub-committees dedicated to different categories of products, and they collectively decide on the list of winning products. The selection process involves evaluations across four key categories: market, quality, outputs, and development. The market category evaluation considers factors such as market share, customer satisfaction, and export performance. The quality category evaluation focuses on product quality and the effectiveness of the quality control system implemented by the firm. The outputs category evaluation considers aspects like taxation and profits. Lastly, the development category evaluation emphasizes innovation. Products that demonstrate independent intellectual property rights and core technologies receive *favourable* consideration.

At the national level, firms that won the China Top Brand Awards had their products exempted from official regular quality checks for five years. The winning firms were also permitted to affix the official China Top Brand Award label on their products for a period of five years in order to distinguish themselves from competitors. In addition, local governments provided winning firms with additional monetary awards, innovation subsidies and preferential treatment in securing bank loans, technological upgrades and exporting.²

The China Top Brand Contest ran from 2001 to 2007. It ceased unexpectedly as the result of the scandal that engulfed the Sanlu dairy group, a recipient of the China Top Brand Award and China's largest powdered milk producer, whose baby formula was found to contain melamine, a chemical used in producing plastics, which was used to ostensibly boost the tested protein level of watered-down milk at the time of quality checks.

Figure 1 presents the number of firms that received the Award and the number of award-winning products between 2001 and 2007. There was a steady increase in the number of award-winning products and firms over the course of the Awards. By the last contest in 2007, 2,517 products had received the Awards.

Responsibility Awards organised by the *People's Daily*, the newspaper of the Chinese Communist Party. Local governments have their own versions of these awards and competitions.

² For example, the Sichuan provincial government stipulated that 'relevant government departments should give priority to award recipients in terms of technology transfer and development, energy supply and loan approval...and facilitate investment and international trade for these firms' (see <https://www.sc.gov.cn/10462/10464/10684/13654/2007/6/8/10369464.shtml>). The Guangdong government awarded 1 million RMB to each winning firm (see http://www.gd.gov.cn/zwgk/gongbao/2005/29/content/post_3361679.html). The Liaoning government awarded 1 million RMB to each winning firm and spent 115 million RMB to subsidise and upgrade winning firms' equipment; in addition, winning firms received additional R&D subsidies (see <http://news.sohu.com/20060911/n245266271.shtml>). In Zhejiang province – one of the most export-oriented economies in China, 363 brands were awarded the 2021 Zhejiang Top Exporting Brands by the provincial Department of Commerce; firms that won have priority access to subsidies for international brand registration, international accreditation and export support and rebate (see https://mp.weixin.qq.com/s/Wpxur2GgqU-Plma06X_p1A).

[Figure 1]

3. Conceptual framework and hypotheses

Signalling theory provides a framework for understanding the effects of awards from the perspective of both givers and recipients. Awards represent a special kind of signal (see, e.g., Frey & Gallus, 2014; Frey & Neckermann, 2010; Gallus & Frey, 2017). From the givers' perspective, Frey and Gallus (2016: 255) argue that awards provide a formal mechanism for givers to 'raise their recipients' intrinsic motivation, while money is more likely to crowd it out'; moreover, 'the threat of withdrawal by the givers...serves as a...control mechanism on future behavior' that the givers value. According to the Chinese government, one such 'future behaviour' that the China Top Brand Awards sought to motivate was 'self-reliant innovation capacity' among winning firms.

Awards are also important for individuals and organisations because they convey appreciation and recognition; establish a special relationship with the donor; entail social and material advantages; and help recipients acquire social status (Frey & Gallus, 2017b). In the context of the present study, winning the China Top Brand Award provided all these benefits to a firm. First, winning one of the highest discretionary awards bequeathed by the central government fulfilled a firm's strong demand for official and social recognition in a socialist market economy. Second, winning the Award helped firms obtain more support from national and local agencies, including more coordinated and nationwide protection of their intellectual property rights. Third, although the China Top Brand Award itself was largely symbolic, local governments provided lucrative prizes and subsidies to winning firms and were instructed to exempt winning products from all official quality checks, saving firms from a large amount of expense and red tape. Last but not least, winning firms set themselves apart from competitors through the 'added benefit of making the distinction visible to one's reference group' (Frey & Gallus, 2017b: 191), and, more widely, signalling to customers their superior product quality (Gallus & Frey, 2017). Below, we further discuss these mechanisms and formulate related hypotheses to be tested in the present study.

3.1 Official brand endorsement and innovation

We hypothesise that winning the China Top Brand Award had a positive direct impact on firm innovation. Firms that won the Award received strengthened and targeted protection of intellectual property rights, reducing uncertainty and spillover losses of innovation activities. A large body of literature suggests that in China there is a positive relationship between intellectual property protection and firm innovation activities (Fang *et al.*, 2017; Li, 2012; Lin *et al.*, 2010; Yueh, 2009). Firms that received the Award were also entitled to be exempted from routine and random quality checks conducted by various government agencies. This had the advantage that it freed up firm resources for innovation activities. In addition, the Award, as certification and recognition, can provide a strong signal to consumers, bring media coverage and boost credibility, leading to more innovation activities in order to maintain excellence (Chattopadhyay *et al.*, 2020; Howell, 2017; Makkonen & Inkinen, 2014).

Hypothesis 1. Receiving the China Top Brand Award has a positive effect on firm innovation.

3.2 Official brand endorsement, research subsidies, financing constraints and innovation

There are two types of awards: confirmatory awards and discretionary awards. Confirmatory awards are routinely granted based on well-defined criteria, while discretionary awards are conferred at the discretion of the principal, often employing somewhat ambiguous criteria that can be subject to interpretation (Frey & Gallus, 2014; Gallus & Frey, 2016). The China Top Brand Award is a discretionary award in which the GAQSIQ, as the relevant

government branch, decides which firms receive the award based on reasonably vague criteria (market, quality, outputs, and development). Discretionary awards require the GAQSIQ, as the principal, to invest more time in the selection of the award than confirmatory awards because the cost of signalling failure – i.e., giving the award to an underserving agent – is higher.³ The relatively vague criteria also allow the government, through the GAQSIQ, to signal that the winners are in favour (Frey & Gallus, 2014). The fact that the government through the GAQSIQ needs to invest time in selecting the winner and does so employing relatively vague criteria presents a strong signal to other government agencies and state-owned banks that the winners of the China Top Brand Award have the approval of government as principal. Hence, winning the Award presented an opportunity for firms to establish or strengthen their relationship with government agencies that allocate various subsidies and other incentives. Innovation subsidies are routinely preferentially allocated to state-owned and politically connected firms in China, resulting in a higher number of filed and approved patents among these firms (Cheng *et al.*, 2019). This is because the agencies allocating such subsidies are looking for heuristic shortcuts in the form of signals as to which firms to make the grants. We hypothesise that firms that won the Award would receive more direct R&D subsidies from these government agencies, which, in turn, would lead to higher innovative outputs (Wu & Cheng, 2011).

Hypothesis 2. Firms that received the China Top Brand Award received more R&D subsidies from the government.

Strong political capital is important in accessing bank loans in China (Zhao & Lu, 2016; Zhou, 2009). Winning the Award can equally serve as a signal/certification of political capital to the state-owned banks that improves a firm's likelihood of raising external finance (Guo *et al.*, 2022; Wu, 2017). We hypothesise that firms that won the Award had better access to banks and other types of financing through a strengthened relationship with the state and state-owned banks (Bussolo *et al.*, 2022; Chan *et al.*, 2012; Cull *et al.*, 2015; Hasan *et al.*, 2017). In addition, firms are more likely to utilise bank finance to fund innovation activities when property rights are better protected (Yano & Shiraishi, 2020), such as via stronger protection for firms that won the China Top Brand Award. Lower financing constraints (i.e., less reliance on internal cash flows to fund investment) stimulate business innovation (Brown *et al.*, 2012; Giebel & Kraft, 2019; Hottenrott & Peters, 2012; Hsu *et al.*, 2014; Sun, 2020).

Hypothesis 3. Firms that received the China Top Brand Award faced less financing constraints.

³ The scandal that engulfed the Sanlu dairy group, a recipient of the China Top Brand Award, that ultimately led to the cessation of the Award is an example of catastrophic signalling failure (see Gallus & Frey, 2016 on signalling failure).

3.3 Official brand endorsement, firm characteristics and innovation

Next, we discuss three firm characteristics; namely, firm ownership, size and performance, as potential moderators between official brand awards and innovation. Ownership is one of the most critical factors in explaining China's innovation (Fang *et al.*, 2017). We conjecture that state firm ownership moderates the effects of winning the Award on innovation for two reasons. First, while some studies suggest that Chinese state-owned enterprises (SOEs) are inefficient in innovation (Zhou *et al.*, 2017), others argue that SOEs have greater incentives to engage in innovation activities (Cao *et al.*, 2020) and are more efficient in using innovation inputs than private firms (Fang *et al.*, 2017; Lo *et al.*, 2022).

Second, awards as signals of intent, generate 'a special bond of loyalty' between principal and agent (Frey & Gallus, 2014, p. 9). Because SOEs have long been vehicles of state capitalism and political influence in China (Stone *et al.*, 2022), the bond of loyalty created by the Award is likely to be magnified for SOEs. SOEs that won the Award had stronger incentives and higher pressure than private firms to demonstrate positive outcomes and loyalty to the government (Li & Zhang, 2007; Su *et al.*, 2019), as a way to fulfil the requirements of the Award. More specifically, given that SOEs are often perceived as instruments of government innovation policy in China (Tonurist & Karo, 2016), SOE Award winners were more likely to perform as the government wished by increasing both the quantity and quality of innovation outputs.

Hypothesis 4. State ownership moderates the relationship between receiving the China Top Brand Award and innovation outputs, such that the positive relationship between receiving the China Top Brand Award and innovation outputs will be strengthened among state-owned enterprises vis-à-vis private enterprises.

Size is a major determinant of firm innovation in China and elsewhere (Acs & Audretsch, 1987; Cohen & Klepper, 1996; Mansfield, 1963; Rodríguez-Pose & Zhang, 2020; Yu *et al.*, 2019; Zhou *et al.*, 2017). There are several reasons why larger firms are more innovative in China. One reason is that larger firms are more likely to perceive innovation objectives as strategically important and, thus, more likely to pursue higher innovation outputs (Guan *et al.*, 2009). Second, larger firms spend more on R&D, employ more R&D staff and can more efficiently utilise their physical and human capital advantage and information and technological capacity to produce innovation outputs (Wei *et al.*, 2017). Third, larger firms are entitled to more generous R&D tax and other related benefits in China (Tian *et al.*, 2020). Finally, because larger firms have more resources, they are better positioned to write-off the occasional unsuccessful R&D project, allowing them to be more risk-taking (Damanpour, 1992). We hypothesise that large firms will be better placed to benefit from the Awards in producing innovation outputs.

Hypothesis 5. Firm size moderates the relationship between receiving the China Top Brand Award and innovation outputs, such that the positive relationship between receiving the China Top Brand Award and innovation outputs will be strengthened among larger firms.

Existing studies find that firm performance is positively related to innovation. High-performing firms are more likely to provide the resources needed for innovation than low-performing ones (Daellenbach *et al.*, 1999). In China, Xu *et al.* (2019: 1226) find that 'high-performing firms are concerned about sustaining their competitive advantage in the long run and will more likely engage in aspirational risk taking such as research and development'. Zhang *et al.* (2021) find that innovation award-winning firms perform better than firms that do not win such awards because they use R&D inputs more efficiently and have better innovation outcomes. We conjecture that, while award-winning firms are likely to be more innovative, high-performing firms, which are more aspirational and efficient, are more likely to spend more on innovation and produce more innovation outputs.

Hypothesis 6. Firm performance moderates the relationship between receiving the China Top Brand Award and innovation outputs, such that the positive relationship between receiving the China Top Brand Award and innovation outputs will be strengthened among better-performing firms.

3.4 Official brand endorsement, intellectual property rights and innovation

Protection of intellectual property rights is another critical factor in explaining China's innovation (Fang *et al.*, 2017). Intellectual property rights protection promotes innovation activities (Allred & Park, 2007; Fang *et al.*, 2017; Hsu *et al.*, 2013; Lin *et al.*, 2010). In China, the level of intellectual property rights protection varies across provinces. The role of intellectual property rights protection in moderating the effect of the Award on innovation is *ex ante* unclear. On the one hand, winning the Award can reduce the risk of counterfeiting for firms located in regions in which intellectual property rights protection is weaker, leading to more innovation outputs (i.e., the substitution effect of the Award on intellectual property rights protection). On the other hand, winning the Award can further strengthen intellectual property rights protection for firms located in regions where intellectual property rights protection is stronger (i.e., the complementary effect of the Award on intellectual property rights protection). Thus, we have the following competing hypotheses.

Hypothesis 7. Intellectual property rights protection moderates the relationship between receiving the China Top Brand Award and innovation outputs, such that the positive relationship between receiving the China Top Brand Award and innovation outputs will be strengthened in provinces in which the level of intellectual property rights protection is higher.

Hypothesis 7a. Intellectual property rights protection moderates the relationship between receiving the China Top Brand Award and innovation outputs, such that the positive relationship between receiving the China Top Brand Award and innovation outputs will be strengthened in provinces in which the level of intellectual property rights protection is lower.

4 Data

We compiled the data used in this study in three steps. First, we manually collected the names of the firms that won the Awards from the 2005-2007 annual official announcements of the China Top Brand Contests. We focus on the period 2005-2007 because the data for the period 2001-2004 was incomplete and a small proportion of the Awards granted in 2004 had a shorter validity period of three years compared to the standard validity period of five years.⁴ In total, there were 1,780 winning firms (award recipients) between 2005-2007, accounting for more than 75 per cent of all recipients in the history of the China Top Brand Contest.

Second, we identified whether A-share companies listed on the Shanghai and Shenzhen Stock Exchanges had received the China Top Brand Award on a year-by-year basis using panel data from the 2002-2012 China Stock Market and Accounting Research Database (CSMAR). In this step, we drop (1) finance companies that do not manufacture and sell physical products; (2) firms that received a delisting warning status because of their abnormal financial or other operational conditions; (3) firms established after 2002, given that firms that received the China Top Brand Award between 2005-2007 need to have been established in, or before, 2002; and (4) firms with missing core information or which are apparent outliers (i.e., their continuous financial variables are above the 99th percentile or below the 1st percentile). Third, we merged the matched data with panel data from the China Research Data Service Platform (CNRDS), which provides information on patent applications and approvals.

⁴ In the 2004 Contest, the validity period for award-winning firms in a few categories (monosodium glutamate (MSG), programable switches, and televisions) was three years.

The resulting panel contains 18,228 observations across 13 years for 85 listed companies that had received the China Top Brand Award and 2,032 listed companies that had never received the Award from 2003 to 2015. For each firm, our panel data covers at least two years before it was awarded the China Top Brand, the entire 5-year validity period of China Top Brands awarded between 2005-2007 and at least three years after the award status expired. Note, that while in theory, a firm could win the Award twice or three times in the period 2005 to 2007, there were very few firms that won the China Top Brand Award multiple times in this period.⁵

[Table 1 here]

5 Methods

We estimate the impact of the China Top Brand award on firm innovation outputs using DiD:

$$y_{icjt} = \alpha + \beta award_i \times validity_{it} + \gamma X_{it} + \mu_t + \sigma_i + \tau_j + \varphi_c + \pi_p \times t + \varepsilon_{it} \quad \dots\dots (1)$$

where y_{icjt} is one of the six outcome variables for firm i of city c in industry j in year t , depending on the exact specification. The outcome variables are the total number of patent applications; the total number of patent applications granted; and the number of patent applications under the patent categories of invention, utility model and design. We also use the number of highly cited patents, defined as the top 20 per cent of cited patents (excluding self-citations) in their respective patent category in a year, to proxy for high-quality patents.

The key variable of interest is the interaction term $award_i \times validity_{it}$, in which $award_i$ is a dummy variable (yes=1; no=0) indicating whether a firm received a China Top Brand award between 2005-2007 and $validity_{it}$ is a dummy variable (yes=1; no=0) indicating the award status was within its 5-year validity period. The coefficient β for the interaction term provides the effects of being awarded a China Top Brand during its validity period, net of differences across years (μ_t), firms (σ_i), industries (τ_j), cities (φ_c) and province time trends ($\pi_p \times t$). X_{it} is a vector of control variables that the literature shows to be correlated with innovation outputs (see Table 1 for details).

In the baseline analysis, we estimate equation (1) using pooled OLS, controlling for time fixed effects, and a two-way fixed effects (TWFE) estimator, which removes both the time fixed effects and time-invariant unobservables. Under the treatment heterogeneity assumption, the TWFE estimate of β is the average treatment effect on the treated (ATT) of the China Top Brand award; that is, the difference between the mean change in outcomes over time experienced by firms in the treated group (i.e., those with awards) adjusted by the mean change in outcomes over time experienced by firms in the untreated group (i.e., those without awards).

The effects of the Award may last beyond the validity period since innovation takes time. To address this, we introduce an additional interaction between award treatment and the post-validity period and estimate the following function using TWFE:

$$y_{it} = \alpha + \beta_1 award_i \times validity_{it} + \beta_2 award_i \times post_validity_{it} + \gamma' X_{it} + \mu_t + \sigma_i + \tau_j + \varphi_c + \pi_p \times t + \varepsilon_{it} \quad \dots\dots (2)$$

where β_1 is the estimate for the treatment effect of receiving an award during its validity period, relative to the period before receiving an award (i.e., the ‘during’ vis-à-vis ‘before’ effect) and β_2 is the estimate for the treatment effect of receiving an Award after its validity period, relative to the validity period (i.e., the ‘after’ vis-à-vis ‘during’ effect).

⁵ Eleven firms were awarded the China Top Brand more than once between 2005-2007, accounting for 0.6% of the sample. In robustness checks on our results, we exclude these firms, and the results are qualitatively similar. Results are available from the authors.

Recent studies suggest that the TWFE estimates may still be biased if there are more than two time periods before and after the treatment (Borusyak *et al.*, 2021; Callaway & Sant'Anna, 2021; De Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun & Abraham, 2021). If there are more than two periods and groups become treated at different points in time, as in the context of the present study, the robustness of TWFE to treatment heterogeneity may not hold. In other words, treatment effects may be heterogeneous across different firms or exhibit dynamics or changes across different time periods. For example, in a TWFE DiD regression with two time periods, firms that had never received an Award over time serve as the comparison group for firms that received an award at some point in time. However, with multiple time periods and variation of treatment (Award) timing, the identification of the ATT in a conventional TWFE DiD model relies on comparisons between newly awarded firms and (1) never awarded firms; (2) not-yet awarded firms; and (3) already awarded firms. The first and second comparisons take the path of outcomes experienced by the newly awarded firms and adjust it to the path of outcomes experienced by firms that have not (yet) received the Award. The third comparison adjusts the path of outcomes for newly awarded firms by the path of outcomes for already awarded firms; however, this is not the path of untreated potential outcomes since it includes treatment effect dynamics, making it difficult to give a clear causal interpretation of β , which is essentially a weighted average of ATT, in equation (1).

Ignoring the treatment effect dynamics in TWFE DiD with multiple periods and variation of treatment timing can lead to a negatively weighted average of ATT, even if the effects of receiving the award treatment is positive for all firms in all time periods or an insignificant weighted average of ATT if the effects of Award are statistically insignificant in some cohorts of awarded firms, but significant in others. While equations (1) and (2) using TWFE can capture some of the relative differences in treatment effects between treated and untreated firms during or after the validity period of the Award, it cannot capture the difference in treatment timing, nor the full dynamics of treatment effects. Thus, we employ a staggered DiD estimator with multiple periods and variations in treatment timing.

We examine two channels and four moderators between the China Top Brand Award and innovation outputs. The first channel is the amount of government research subsidies a firm received. The second channel is financing constraints. We follow the approach of Kaplan and Zingales (1997) in constructing an index of financing constraints for each firm.⁶ A higher value of the index indicates a higher level of financing constraints. The first moderator is state ownership, which is a dummy variable set equal to one if a firm is predominantly owned by the state; otherwise, zero. The second moderator is firm size, measured by a dummy variable (yes=1; no=0) denoting whether a firm's total assets are higher than the mean in its industry in a particular year.⁷

The third moderator is firm performance, measured by a dummy variable (yes=1; no=0) denoting whether a firm's return on assets (ROA) is higher than the mean ROA in its industry each year, following the approach in Xu *et al.* (2019). The fourth moderator is a dummy variable (yes=1; no=0) denoting whether the provincial index of

⁶ We estimate the index of financing constraints through the following steps. First, for firm i in year t , we create dummy variables across five categories: (1) cash flow/lagged total assets (CF_{it}/A_{it-1}); (2) cash dividends/lagged total assets (DIV_{it}/A_{it-1}); (3) cash holdings/lagged total assets (C_{it}/A_{it-1}); (4) debt to asset ratio (LEV_{it}); and (5) Tobin's Q (Q_{it}) in year i . If a firm's value is lower than the median value of all firms in a year in categories 1-3, a value of one is assigned; otherwise, zero. If a firm's value is higher than the median value of all firms in a year in categories 4 and 5, a value of one is assigned; otherwise, zero. Second, we sum the five dummy variables to create a variable (KZsum) in the range of 0-5. Third, we use ordered logit to regress KZsum on CF_{it}/A_{it-1} , DIV_{it}/A_{it-1} , C_{it}/A_{it-1} , LEV_{it} and Q_{it} to estimate the coefficients for each independent variable. Fourth, we use the estimated coefficients (weights) to estimate the Kaplan and Zingales (1997) index for firm i in year t .

⁷ Existing studies have used total assets, total sales or number of employees as indicators of firm size. In China, classification of firm size is traditionally based on production capacity (Guan *et al.*, 2009). Thus, in this study we use total assets as an indicator of firm size (Dang *et al.*, 2018; Hall & Weiss, 1967; Qiao *et al.*, 2014).

intellectual property rights protection from the China Market Index Database is higher than the mean value of the index; a higher index level indicates a higher level of intellectual property rights protection.

6 Results

Main findings for Hypothesis 1

Table 2 presents the baseline results. Panel A presents the results from pooled OLS regression of patent outcomes on receiving a China Top Brand award. Models A1-A9 show that receiving an award is positively associated with all outcomes. For example, Models A1-3 show that winning the Award is associated with a 74 percentage points increase in the total number of patent applications, a 67 percentage points increase in the total number of patents granted and an 11 percentage points increase in the number of highly cited patents. The results in Panel B, estimated using pooled OLS DiD, are quantitatively similar to those from pooled OLS.

[Table 2 here]

Results from TWFE DiD in Panel C show that, after accounting for the endogeneity of receiving a China Top Brand award and time-invariant unobservables, the coefficients on receiving an award are still significant, but smaller than those in pooled OLS DiD. These findings are consistent with the endogeneity of winning the Award and time-invariant unobservables biasing the estimates upward in the OLS results (Panels A and B). Meanwhile, we find that the impacts of winning an Award on invention patents granted (Model C5), design patent applications (Model C8) and design patents granted (Model C9) are not statistically significant. One potential explanation for this finding is that ignoring the treatment effect dynamics in TWFE DiD with multiple periods and variation of treatment timing can lead to a negatively weighted average of ATT, even if the effects of receiving the award treatment are positive for all firms in all periods or an insignificant weighted average of ATT if the effects of winning the Award are statistically insignificant in some cohorts of awarded firms, but significant in others.

Panel D presents the results from TWFE dynamic DiD during and after the validity of the Award. Except for Model D1 on total patent applications where the Award does not have an effect after its validity period and Model D8 on design patent applications where the Award does not have an effect during its validity period, the Award has a positive effect on innovation outcomes during and after its validity. The results suggest that we need to consider the lasting or delayed effects of receiving an Award on innovation outcomes. In general, the estimated coefficients from TWFE dynamic DiD are smaller than those from OLS in Panels A and B, but greater than those from TWFE DiD in Panel C. These findings are consistent with OLS biasing the estimates upward, but TWFE DiD ignoring the treatment effect dynamics and biasing the estimates downward. One exception is that the TWFE dynamic DiD estimates (13.9-14.6 percentage points) for receiving an award on the number of highly cited patents are similar to, or slightly higher than, those in the OLS models in Panels A and B (11.1-13.7 percentage points). This finding is consistent with endogeneity operating in two directions, depending on the outcome measures, resulting in a quantity-quality trade-off. For instance, while self-selection into the contest is positively associated with the quantity of patent applications and granted patents, it is negatively associated with the quality of patents.

Panel E presents the single average ATT across all treated observations over all post-award periods (i.e., years during and after the validity of the Award) using the DiD design with staggered adoption of treatment and the imputation approach of Borusyak *et al.* (2021). It shows that receiving an Award has a positive effect on all the patent outcomes. The coefficients from staggered DiD using an imputation estimator suggest that TWFE DiD in Panel C underestimates the effects of the Award. In general, the magnitude of the coefficients employing staggered DiD are closer to those from the TWFE dynamic DiD in Panel D, suggesting that it is crucial to capture

the full spectrum of impacts over the years and across different treatment times for individual firms. Similar to the findings from TWFE dynamic DiD, the imputation dynamic DiD estimate (15.0 percentage points) for receiving an award on the number of highly cited patents is slightly higher than those in the OLS models in Panels A and B (11.1-13.7 percentage points). This result is, again, consistent with the idea that endogeneity can operate in two directions across the quantity and quality measures of innovation outputs.

Robustness checks for Hypothesis 1

An advantage of our DID model is that it accounts for the level effects of receiving the Award and group difference across firms which received, or did not receive, the Award over time. The DID model relies on a parallel trend assumption between firms which received, or did not receive, the Award. One approach to test this is to conduct a placebo test by using a hypothetical treatment to validate the DiD specification (Cheng *et al.*, 2021; Cheng & Smyth, 2021; Gertler *et al.*, 2016). We push the Award for winning firms backward by one year. These hypothetical awards should not have (positively) affected firms' innovation outputs. Results for the experiment in Table 3 shows that the parallel trend assumption is satisfied, which lends confidence to the DID estimation.

[Table 3 here]

One may still be concerned about the pre-trend in a more extended period prior to the Award. For example, to prepare for the contest, a firm may invest more in innovation in order to obtain a better chance of winning the Award. To address this, we graphically present the pre-trend coefficients of Award and the post-treatment coefficients of staggered DiD across the post-treatment years. Figure 2 shows that the pre-trend coefficients are insignificant in most specifications, providing strong support that parallel trends are satisfied.

[Figure 2 here]

Three exceptions in the pre-trend tests in Figure 2 are the total patents granted (A2), utility patents granted (C2) and design patent applications (D1), where the pre-trend coefficients are marginally significant one year prior to receiving the Award. One explanation is that a firm may anticipate that it will win the Award and, thus, start to invest more in utility and design patents, which can be more easily copied by competitors, prior to the contest. This is consistent with the notion that some units may anticipate being treated in the future and, thus, adjust their pre-treatment behaviour immediately prior to the treatment. While this does not invalidate our findings that, as illustrated in Figure 2, the treatment effects of receiving the Award are significant across the post-treatment years (patterns vary), one may be concerned about to what extent treatment anticipation, if any, may bias the DiD estimates. To address this issue, we reestimate the imputation staggered DiD in Panel E in Table 2 by allowing for one-year treatment anticipation. Table 4 shows that, after allowing for treatment anticipation, the effects of receiving the Award remain significant and the magnitudes of the effects are greater than in Panel E in Table 2. This result is consistent with the argument that accounting for the anticipation effect in the pre-trends increases the estimated treatment effect compared to a DiD model that ignores anticipation (Laporte & Windmeijer, 2005; Malani & Reif, 2015). In sum, our findings are robust to the anticipation effects of winning the award.

[Table 4 here]

While the national China Top Brand Award ceased in 2007, some provincial Top Brand Award Contests commenced and remain. In a robustness check, we further control for whether a firm has received a provincial Top Brand Award in the sampled period. The results in Table 5 show that receiving a national China Top Brand Award has a positive effect on all innovation outputs, even after controlling for provincial Awards.

[Table 5 here]

Channels and Moderating effects (Hypotheses 2-7)

Table 6 presents the results on government research subsidies and financing constraints as potential channels. Model 1 shows that winning the Award led to increased research subsidies received from the government. Thus, Hypothesis 2 is supported. However, Model 2 shows no statistically significant relationship between winning the Award and financial constraints. Thus, Hypothesis 3 is not supported.

[Table 6 here]

Panel A in Table 7 shows that award-winning SOEs have higher patent outputs than private firms. Thus, Hypothesis 4 is supported. Panel B in Table 7 shows that larger award-winning firms have higher patent outputs than smaller firms. Thus, Hypothesis 5 is supported. Panel C in Table 7 shows that better-performing award-winning firms have higher patent outputs than less well-performed firms (except for granted design patents, for which the coefficient is not significant in model C9). Thus, Hypothesis 6 is supported.

[Table 7 here]

Table 8 suggests that award-winning firms in provinces with a higher level of intellectual property rights protection have higher patent outputs (except for the total number of applications in model 1) than those in provinces with lower protection. These findings suggest that the Award supplements the role of intellectual property rights protection in generating more innovation outputs. Hypothesis 7 is supported.

[Table 8 here]

7 Discussion and conclusions

We employ a unique dataset to examine the causal impacts of winning the China Top Brand Award on firm innovation. Employing DiD models to address endogeneity, we find that winning the Award has a positive effect on both patent quantity and quality. We also find that the positive effects of the Award on innovation are channelled through a greater amount of government research subsidies allocated to winning firms. We also find that such positive effects are more pronounced among state-owned, larger and high-performing firms, as well as in regions where protection of intellectual property rights is higher. These findings provides novel evidence on the functions of such awards in driving and facilitating innovation at a time when governments are increasingly interested in employing competitive national innovation awards at firm and individual levels to encourage innovation (Marx & Piekkola, 2007; Wessner, 2007). While the China Top Brand Award was short-lived, other official and national awards and schemes have flourished across different levels of government in China, showing strong demand and supply for such awards, recognitions and honours. Our findings provide suggestive evidence that such awards may be important in explaining China's global leadership in patents.

Our findings contribute to the emerging economics of awards which investigates widely used, yet scarcely studied, nonmonetary awards (Frey & Gallus, 2017b). In particular, we address the empirical challenge of examining whether an award further raises the performance of its recipients, who are already among the best performers (Frey & Gallus, 2017b). Our findings on the direct and channelled effects of the Award on innovation are consistent with the idea that on receiving an award 'the motivation of the recipients is bolstered; or a Matthew

effect occurs (Azoulay *et al.*, 2014; Merton, 1968), meaning that the successful award winners enjoy an elevated status and therefore get better access to resources, which facilitates higher performance' (Frey & Gallus, 2017b: 196).

There are several avenues for future research. One suggestion is to compare the effects of winning a cash price and nonmonetary award on firm innovation employing an experimental setting (see Graff Zivin & Lyons, 2021). Another suggestion is to examine other variables that mediate the relationship between awards and firm innovation (and other positive outcomes), focusing on the factors that motivate management and other internal workings within the firm. Such a study could survey managers in firms that have and have not won awards or use an experiment. We have examined how winning awards affects behaviour in a positive way, but clearly winning awards can also lead to poor corporate behaviour through perhaps engendering a sense of arrogance or complacency as the example of the Sanlu dairy illustrates. Future research could explore the perverse effects of winning awards. Finally, as discussed above, while the China Top Brand Award was the predecessor for many similar awards in China. Future studies could examine the effects of winning these awards on various firm outcomes.

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Figure 1. China Top Brand Awards, 2001-2007

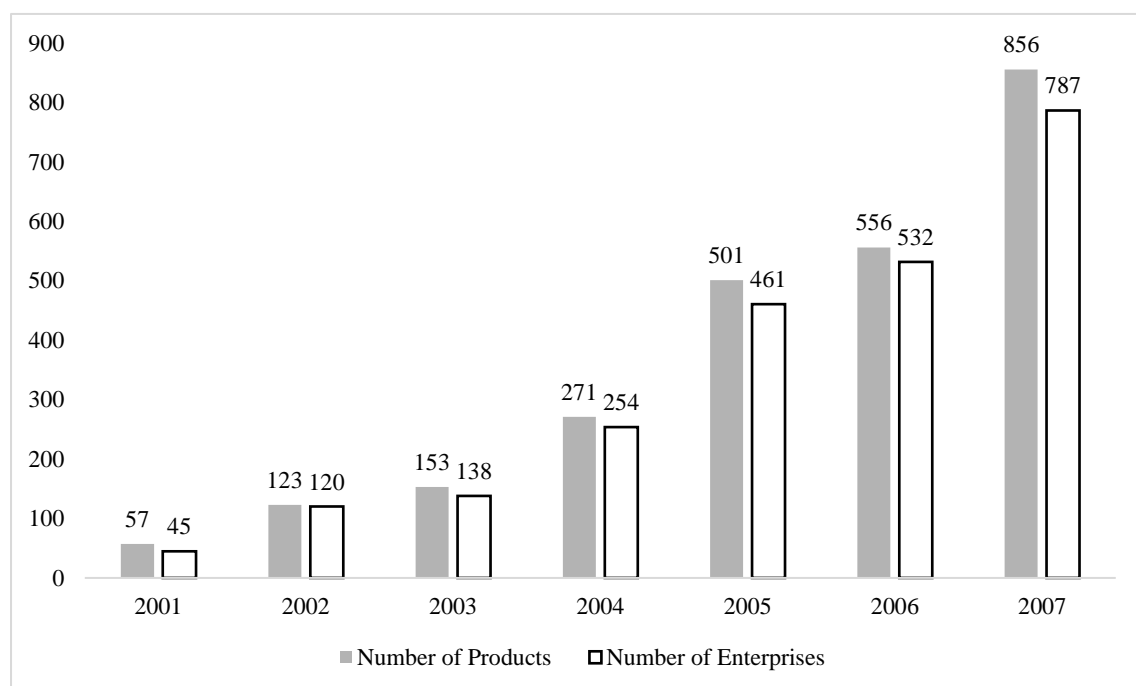


Figure 2. Pre-trend and post-treatment coefficients of staggered difference-in-differences

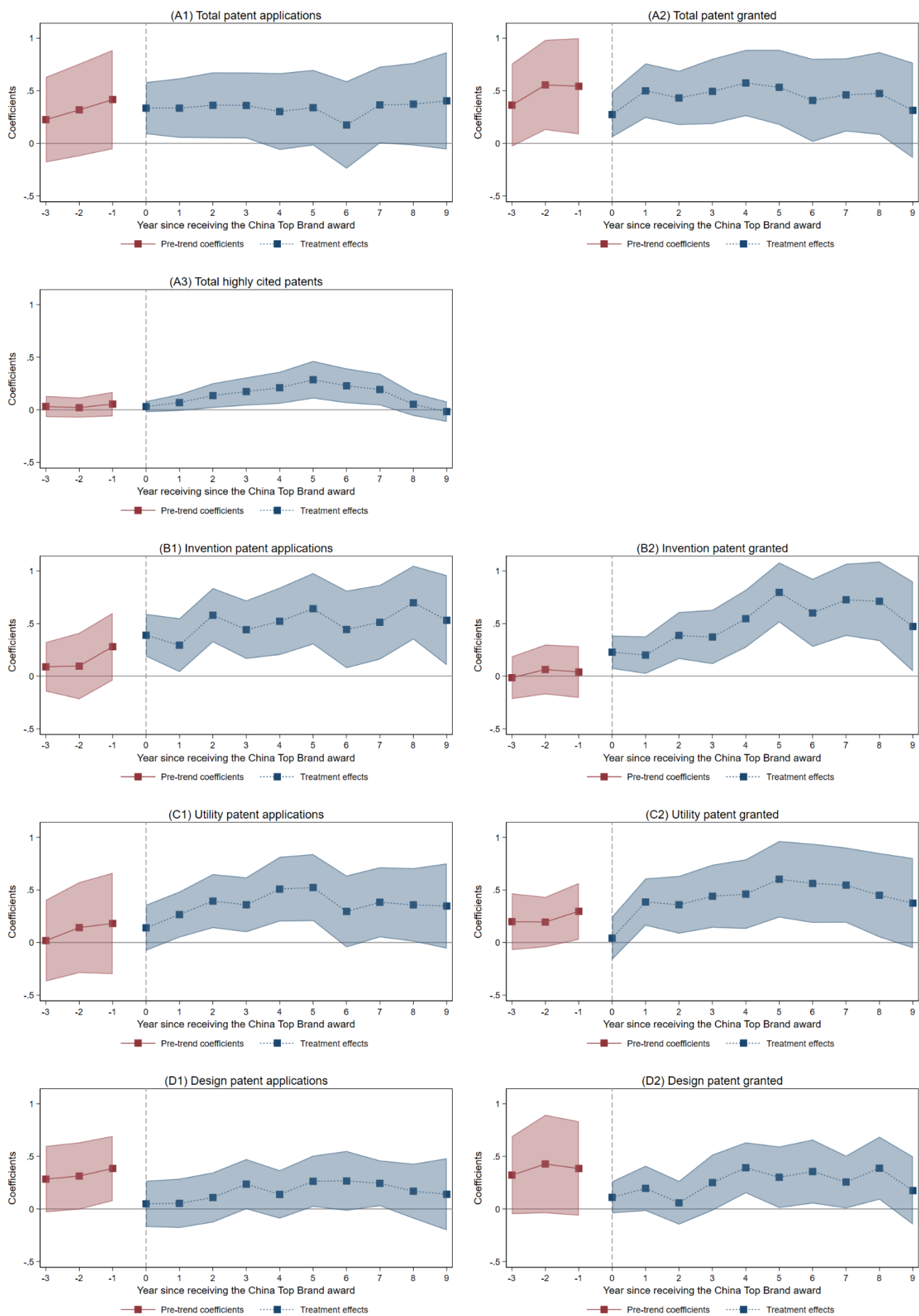


Table 1. Summary statistics

	Definitions	Mean	S.D.
<i>Dependent variables</i>			
Total number of patent applications	Inverse hyperbolic sine (IHS) transformation of the number	22.3255	100.8549
Total number of patents granted	Same as above		
Total number of highly cited patents	Same as above	0.3054	2.7604
Number of invention patent applications	Same as above	8.8020	45.0215
Number of invention patents granted	Same as above		
Number of utility patent applications	Same as above	10.6705	51.4813
Number of utility patents granted	Same as above		
Number of design patent applications	Same as above	2.8531	17.3569
Number of design patents granted	Same as above		
<i>Key independent variables of interest</i>			
China Top Brand Award	Yes=1; no=0	0.0675	0.2510
Validity period of the China Top Brand Award	Yes=1; no=0	0.0323	0.1767
<i>Control variables</i>			
Debt to asset ratio		0.4663	0.2046
Cash (or equivalent) to asset ratio		0.1690	0.1364
Returns on asset (ROA)		0.0542	0.0593
Earnings before interest and tax (EBIT) to asset ratio	The basic earnings power ratio	0.0542	0.0593
Fixed asset to total asset ratio		0.2585	0.1811
Asset's book value to market value ratio		0.6566	0.2399
State-owned enterprise	Yes=1; no=0	0.5690	0.4952
Total assets	In natural logarithm	21.7516	1.1914
Herfindahl-Hirschman index	Measure of market concentration of an industry	0.0969	0.1196
City GDP per capita	GDP per capita in natural logarithm in the city where the company locates	10.7931	0.7259
<i>Fixed effects</i>			
Year fixed effects	13 years	Available from the authors	
Firm fixed effects	18,228 firms	Available from the authors	
Industry fixed effects	72 industries	Available from the authors	
City fixed effects	231 cities	Available from the authors	

Table 2. China Top Brand Award and patent outcomes

	Total			Invention patent		Utility patent		Design patent	
	Apps	Granted	Highly cited	Apps	Granted	Apps	Granted	Apps	Granted
Panel A: Pooled OLS	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)	(A8)	(A9)
Award	0.554***	0.511***	0.105**	0.455***	0.352***	0.429***	0.430***	0.329***	0.302***
	(5.04)	(4.95)	(2.51)	(4.48)	(4.05)	(4.11)	(4.13)	(3.18)	(2.89)
Observations	18223	18223	18223	18223	18223	18223	18223	18223	18223
Panel B: Pooled OLS DiD	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)	(B9)
Award \times validity	0.562***	0.591***	0.128***	0.479***	0.330***	0.463***	0.430***	0.278***	0.283***
	(5.10)	(5.67)	(2.78)	(4.70)	(3.85)	(4.33)	(3.97)	(2.94)	(2.88)
Observations	18223	18223	18223	18223	18223	18223	18223	18223	18223
Panel C: TWFE DiD	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)	(C7)	(C8)	(C9)
Award \times validity	0.186***	0.278***	0.074**	0.200***	0.087	0.218***	0.149**	0.018	0.076
	(2.70)	(4.45)	(2.35)	(3.07)	(1.38)	(3.61)	(2.25)	(0.35)	(1.59)
Observations	18090	18090	18090	18090	18090	18090	18090	18090	18090
Panel D: TWFE dynamic DiD	(D1)	(D2)	(D3)	(D4)	(D5)	(D6)	(D7)	(D8)	(D9)
Award \times during validity	0.325***	0.483***	0.130***	0.427***	0.332***	0.353***	0.354***	0.136	0.243***
	(2.61)	(4.31)	(2.94)	(3.79)	(3.60)	(3.29)	(2.86)	(1.58)	(2.84)
Award \times after validity	0.242	0.380**	0.136**	0.453***	0.537***	0.294**	0.439**	0.222**	0.305**
	(1.47)	(2.36)	(2.50)	(2.81)	(3.68)	(2.01)	(2.56)	(2.05)	(2.42)
Observations	18090	18090	18090	18090	18090	18090	18090	18090	18090
Panel E: Imputation DiD	(E1)	(D2)	(D3)	(D4)	(D5)	(D6)	(D7)	(D8)	(D9)
Award \times post-award period	0.331**	0.449***	0.140***	0.498***	0.494***	0.352***	0.416***	0.176**	0.262***
	(2.30)	(3.32)	(2.99)	(4.00)	(4.42)	(2.94)	(3.14)	(2.01)	(2.76)
Observations	18030	18030	18030	18030	18030	18030	18030	18030	18030

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. t - or z -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, year fixed effects, industry fixed effects, city fixed effects and province time trends. In Panels C and D, firm fixed effects are also controlled for. Full results are available on request.

Table 3. China Top Brand Award and patent outcomes – placebo test

TWFE DiD results	Total			Invention patent		Utility patent		Design patent	
	Apps	Granted	Highly cited	Apps	Granted	Apps	Granted	Apps	Granted
	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)	(C7)	(C8)	(C9)
Hypothetical award \times validity	-0.018	-0.046	-0.046	-0.157	-0.307***	-0.049	-0.194*	-0.128*	-0.137
	(-0.17)	(-0.41)	(-1.31)	(-1.45)	(-2.94)	(-0.53)	(-1.72)	(-1.75)	(-1.51)
Observations	18090	18090	18090	18090	18090	18090	18090	18090	18090

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. t -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, year fixed effects, industry fixed effects, city fixed effects and province time trends. In Panels C and D, firm fixed effects are also controlled for. Full results are available on request.

Table 4. China Top Brand Award and patent outcomes – allowing for anticipation effects

Imputation DiD results	Total			Invention patent		Utility patent		Design patent	
	Apps	Granted	Highly cited	Apps	Granted	Apps	Granted	Apps	Granted
1-year anticipation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ATT in the placebo year of award	0.158	0.089	0.034	0.201**	0.005	0.090	0.101	0.104	0.035
	(1.48)	(0.97)	(1.21)	(2.23)	(0.07)	(0.85)	(1.27)	(1.35)	(0.46)
ATT after allowing for anticipation	0.370**	0.453***	0.151***	0.554***	0.483***	0.395***	0.430***	0.176**	0.239***
	(2.41)	(3.35)	(3.10)	(4.29)	(4.30)	(3.02)	(3.18)	(1.87)	(2.45)
Observations	17988	17988	17988	17988	17988	17988	17988	17988	17988

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. z -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, year fixed effects, industry fixed effects, city fixed effects and province time trends. Full results are available on request.

Table 5. China Top Brand Award and patent outcomes – controlling for provincial Top Brand Awards

Imputation DiD results	Total			Invention patent		Utility patent		Design patent	
	Apps	Granted	Highly cited	Apps	Granted	Apps	Granted	Apps	Granted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
National award \times post-award period	0.326**	0.441***	0.138***	0.494***	0.490***	0.354***	0.415***	0.175**	0.261***
	(2.26)	(3.26)	(2.96)	(3.97)	(4.37)	(2.96)	(3.13)	(1.99)	(2.74)
Provincial award	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18030	18030	18030	18030	18030	18030	18030	18030	18030

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. z -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, year fixed effects, industry fixed effects, city fixed effects and province time trends. Full results are available on request.

Table 6. China Top Brand Award and patent outcomes – government research subsidies and financing constraints as channels

Imputation DiD results	Government research subsidy	Financing constraints
	(1)	(2)
Award \times post-award period	2.871*** (2.59)	0.0106 (0.63)
Observations	12455	15818

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. z -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, year fixed effects, industry fixed effects, city fixed effects and province time trends. Full results are available on request.

Table 7. China Top Brand Award and patent outcomes – firm characteristics as moderators

Imputation DiD results	Total			Invention patent		Utility patent		Design patent	
	App	Granted	Highly cited	App	Granted	App	Granted	App	Granted
Panel A: state ownership	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)	(A7)	(A8)	(A9)
Award \times post-award period \times SOE	0.326**	0.483***	0.139***	0.519***	0.528***	0.406***	0.435***	0.171*	0.348***
	(2.04)	(3.23)	(2.70)	(3.76)	(4.21)	(3.12)	(2.90)	(1.80)	(3.22)
Observations	17799	17799	17799	17799	17799	17799	17799	17799	17799
Panel B: firm size	(B1)	(B2)	(B3)	(B4)	(B5)	(B6)	(B7)	(B8)	(B9)
Award \times post-award period \times large firm	0.914**	1.015***	0.557***	0.927**	1.209***	0.687*	1.117***	0.517***	0.264
	(2.22)	(2.98)	(3.42)	(2.31)	(3.84)	(1.89)	(2.69)	(2.59)	(1.27)
Observations	17133	17133	17133	17133	17133	17133	17133	17133	17133
Panel C: firm performance	(C1)	(C2)	(C3)	(C4)	(C5)	(C6)	(C7)	(C8)	(C9)
Award \times post-award period \times high performance	0.914**	1.015***	0.557***	0.927**	1.209***	0.687*	1.117***	0.517***	0.264
	(2.22)	(2.98)	(3.42)	(2.31)	(3.84)	(1.89)	(2.69)	(2.59)	(1.27)
Observations	17133	17133	17133	17133	17133	17133	17133	17133	17133

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. χ^2 -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, interaction term between award and post-award period, year fixed effects, industry fixed effects, city fixed effects and province time trends. Full results are available on request.

Table 8. China Top Brand Award and patent outcomes – intellectual property rights as a moderator

Imputation DiD results	Total			Invention patent		Utility patent		Design patent	
	App	Granted	Highly cited	App	Granted	App	Granted	App	Granted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Award \times post-award period \times higher IP rights	0.256	0.315**	0.135**	0.449***	0.469***	0.335**	0.379**	0.178*	0.237**
	(1.62)	(2.11)	(2.46)	(3.38)	(3.68)	(2.48)	(2.49)	(1.70)	(2.17)
Observations	17773	17773	17773	17773	17773	17773	17773	17773	17773

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. χ^2 -statistics in parentheses. Standard errors are clustered at the firm level. All specifications include a full set of control variables, interaction term between award and post-award period, year fixed effects, industry fixed effects, city fixed effects and province time trends. Full results are available on request.