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Improving Innovation Quality in Responding to Rigorous Intellectual Property Logic in Emerging Economies? The Role of Subsidy Policy for Patenting Overseas and International Imprinting

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This study investigates the link between subsidy policy for patenting overseas (SPPO) and the innovation quality of emerging economy firms, focusing on the role of international imprinting. Through the theoretical lenses of institutional logics and imprinting, we hypothesize that SPPO, which embodies a rigorous intellectual property (IP) logic, enhances innovation quality, particularly in firms with international imprinting. Analysing Chinese listed firms in the computers, telecommunications and electronics sectors during 2004–2021 using matching and difference-in-differences techniques, we find that firms responding to SPPO show improved innovation quality. This effect is amplified by international imprinting at the board and organizational levels, both separately and jointly. These findings highlight that international imprinting enhances the effectiveness of government policy that embodies rigorous IP logic, offering valuable insights for managers and policymakers seeking to foster high-quality innovation in emerging economies.

Introduction

As emerging economies (EEs) appear as the new powerhouses of research and development (R&D), innovation by emerging economy firms (EEFs) has garnered significant interest from academia, business and policymakers (Anand *et al.*, 2021; Shankar and Narang, 2020). Owing to market failures associated with incomplete appropriation of returns on investments, government interventions through subsidies are commonly employed to incentivize firms to invest in R&D (Schwartz and Clements, 1999). However, research also proposes that R&D subsidies have crowding-out effects, diminishing corporate R&D activities (Dimos and Pugh, 2016). This tension has spurred empirical examination of the role of subsidy policies in firms' innovation outcomes (for reviews and meta-analytical studies, see Becker, 2015; Bloom, Van Reenen and Williams, 2019; Castellacci and Lie, 2015; Dimos and Pugh, 2016; Dimos *et al.*, 2022). Notwithstanding these contributions, this research stream has predominantly focused on innovation in general, with limited explicit attention on innovation quality. This gap is important because, for both EEFs' competitiveness upgrading and EEs' catch-up endeavours, the quality, not just quantity, is paramount (Rui and Bruyaka, 2021; Wang, Farag and Ahmad, 2021b). Firms pursuing quantity-oriented innovation strategies may do so for strategic purposes, but this approach can result in quantity being associated with low-quality patents with limited technological and economic impact (Dziallas and Blind, 2019). While a certain quantity of innovation is necessary to ensure quality, the emphasis should be on quality as it drives profitability and competitiveness (Zhao *et al.*, 2023). EEs, beset by

resource constraints, specifically need to ascertain that subsidies are for value creation, not value destruction (Guo, Guo and Jiang, 2018; Wang, Boateng and Hua, 2021a; Yi *et al.*, 2021). Subsidies leading to quality innovations can establish the groundwork for sustainable development and economic resilience through effective resource allocation and utilization.

Given the diverse forms of R&D subsidies (Becker, 2015; Bloom, Van Reenen and Williams, 2019), we concentrate on a non-mandatory policy designed to encourage EEFs to pursue high-quality innovation, that is, the subsidy policy for patenting overseas (SPPO). This policy, implemented in EEs like China and India,[1] offers subsidies to incentivize EEFs to file patents abroad. It is grounded in institutional logics – representing the taken-for-granted comprehension of what is meaningful in a setting (Friedland and Alford, 1991; Thornton, Ocasio and Lounsbury, 2012). We conceptualize SPPO as embodying rigorous intellectual property (IP) logic, the institutional logic underpinning the political and economic systems related to IP. This is because the grant of subsidies demands that applicants satisfy sophisticated technological criteria and stringent regulatory standards of developed economies (DEs). This contrasts starkly with the prevalent weak IP protection regimes of EEs, due to the absence of market-supporting institutions and limited punitive measures for infringement (Peng *et al.*, 2017). The coexistence of competing IP logics in EEs raises two research questions:

- *Does SPPO embodying rigorous IP logic lead to enhanced innovation quality of EEFs?*
- *If affirmative, considering the non-compulsory nature of the policy, which mechanism propels EEFs' responsiveness to the policy in their quest for quality innovation?*

To address these original questions, we utilize the theoretical lens of institutional logics, particularly emphasizing IP logics, to explore the nexus of EEFs' responsiveness to SPPO and innovation quality. Subsequently, we employ imprinting theory to examine international imprinting as a novel moderating mechanism. Imprinting is defined as 'a process whereby, during a brief period of susceptibility, a focal entity develops characteristics that reflect prominent features of the environment, and these characteristics continue to persist despite significant environmental changes in subsequent periods' (Marquis and Tilcsik, 2013: 199). International imprinting, the international dimension of institutional imprinting, emphasizes the imprint exerted by the institutional environment of DEs, where rigorous IP logic prevails. Entities exposed to such environments may be imprinted with values, cognitive frameworks and willingness to adhere to rigorous IP logic, consistent with the argument that entities can be acculturated to their host-country context (Han *et al.*, 2019; Le and Kroll, 2017; Wu *et al.*, 2016; Xu *et al.*, 2021). This alignment between values and cognitive frameworks derived from international imprinting and the guiding principles of rigorous IP logic shapes decision-makers' responses. Firms' international imprinting manifests at the board and organizational level, captured by the international educational exposure of the board of directors (BoD) in DEs and outward foreign direct investment (OFDI) in DEs, respectively. Board directors and foreign subsidiaries established through OFDI bear the imprint of their early exposure to DEs, making them likely to allocate resources and take actions conducive to quality innovation. Consequently, in EEFs' quest for innovation, international imprinting is anticipated to amplify their responsiveness to SPPO underpinned by rigorous IP logic.

Empirically, we leverage a dataset of Chinese listed firms in the computers, telecommunications and electronics sectors during 2004–2021. This context is suitable for three reasons. First, after decades of emulating and learning from foreign inventors, Chinese firms have advanced, becoming formidable competitors and collaborators in the global innovation landscape (Rui and Bruyaka, 2021; Wang, Farag and Ahmad, 2021b). Their domestic patents have surged, and their ownership of foreign patents has increased significantly (Ebersberger, Feit and Mengis, 2023; Jiang, Shi and Jefferson, 2020). Second, the Chinese government actively implements R&D policies, benchmarking against those in DEs (Guo, Guo and Jiang, 2018). SPPO, initiated by the Chinese government in 2009, represents an ideal event for employing a quasi-experimental method, the difference-in-differences (DiD) approach, combined with propensity score matching (PSM) (PSM-DiD) (Lee *et al.*, 2024; Stuart *et al.*, 2014; Wing, Simon and Bello-Gomez, 2018). Third, firms in this industry exhibit proportionately high-technological intensity in producing competitive inventions and demonstrating readiness to compete internationally (see Appendix A).

This paper makes three main contributions to research on EEFs' innovation strategy. First, we advance the innovation literature by integrating the theoretical lenses of institutional logics and imprinting to understand firms' innovation strategies amidst institutional complexity characterized by conflicting IP logics. Through this integration, we construct a conceptual model that interprets EEFs' innovation quality as an organizational response to the appeal of rigorous IP logic manifested by home-government policy, SPPO,

[1]For the subsidy policy introduced by the Chinese government on reimbursing the cost of patents, see https://www.gov.cn/zwgk/2012-05/31/content_2149501.htm; and by the Indian government, see https://www.origiin.com/2020/05/15/schemes-of-government-to-reimburse-the-cost-of-patents/.

with this response being moderated by international imprinting. As institutional logics are internalized to shape organizational actions (Durand and Thornton, 2018), EEFs' responses to SPPO may be associated with innovation quality. Moreover, firms' attribute of international imprinting acts as a novel moderating mechanism, reinforcing EEFs' agency to echo rigorous IP logic in their quest for quality innovation. While previous work has primarily examined the roles of institutional logics and imprinting in shaping firms' behaviours/actions (e.g. Jia, Huang and Man Zhang, 2019; Maksimov, Wang and Luo, 2017; Wang, Du and Marquis, 2019; Zhang, Zhang and Jia, 2022), their combined effects have been underexplored, leaving a gap in our understanding of their interplay. We address this gap and deepen our comprehension by underscoring the importance of considering both the underlying logic of government policy and the internalized values and cognitive frameworks from international imprinting in shaping innovation quality. Our model, based on the integration of two lenses, makes a significant theoretical contribution by addressing the originality criterion as outlined by Corley and Gioia (2011) because it provides deeper insights into the role of institutional force and firm attributes in shaping corporate innovation strategy, uncovering nuances and dynamics that might not be fully understood when using either theory in isolation.

Second, we contribute to imprinting research by delineating the independent and joint effects of international imprinting at board and organizational levels. While existing research often concentrates on singular sources of imprinting – for example, ideological (Liu and Luo, 2022; Marquis and Qiao, 2020; Wang, Du and Marquis, 2019), career (Azoulay, Liu and Stuart, 2017; Hahn, Minola and Eddleston, 2019; Zhang, Zhang and Jia, 2022) and early-life experience (Long *et al.*, 2020) – we recognize diverse sources of international imprinting. We demonstrate that the positive moderating effect of international imprinting at the board level is further accelerated by OFDI imprinting. By examining international imprinting across different levels within the firm, we highlight that their alignment regarding how business activities should be conducted and the legitimate means to succeed can jointly boost EEFs' agency amidst institutional complexity, and thus their innovation quality. Addressing this previously underexplored aspect in imprinting research, we make an original theoretical contribution by adding depth and demonstrating multi-level imprints, specifically their intersection in influencing firms' strategic responses in a complex and interconnected manner.

Third, our research responds to the call for multilevel analyses at the intersection of innovation and international business research (Andersson *et al.*, 2016). Beyond signifying the link between firms' innovation quality and the international imprints of their people and subsidiaries, we emphasize the macro–micro link between national R&D policy and organizational responses to the institutional logic behind such policies. The presence of competing IP logics underpins institutional complexity governing innovation in EEs. Our research accentuates the multifaceted role of governments as enablers of quality innovation by demonstrating how policy and institutional forces can practically influence corporate innovation strategies, meeting the utility criterion of theoretical contributions as described by Corley and Gioia (2011).

Theoretical Background

Institutional logics and IP logics

Institutional logics encompass the 'socially constructed, historical pattern of symbols and material practices including assumptions, values and rules by which individuals and organizations produce and reproduce their material substance, organize time and space and provide meanings to their social reality' (Friedland and Alford, 1991: 243). These symbols and practices are accessible for individuals, groups and organizations to elaborate and utilize to their own advantage (Thornton, Ocasio and Lounsbury, 2012). However, societal institutions tend to be composed of multiple and complex subsystems, where each has its own logic to constrain behaviours and provide opportunities for agency and change. Market liberalization and global economic integration over past decades have introduced competing logics to EEs. This study delves into an important aspect of institutional logics – IP logics.

IP typically resides within the widespread category of institutional frameworks governing the protection of intangible assets, including inventions. The criteria used in examining the novelty of invention and defining statutory damages for infringement, validation of IP rights and enforcement of court decisions are central to the level of IP protection afforded by a country (Peng *et al.*, 2017). Consequently, we consider IP logic as the organizing guidance regarding technological standards of patent filing and legal enforcement standards for patent protection, classifying IP logic into two types: rigorous and weak logics. The well-established economic and institutional environment in DEs tends to favour rigorous IP logic, which supports appropriability and entrepreneurial opportunity to fuel free-market competition (Prud'homme, 2019). Conversely, the laggard economic status may prompt emerging economy governments to adopt weak IP logic, which pays less attention to infringement and violation of IP rights, thereby providing catch-up opportunities for domestic firms (Băzăvan, 2019; Peng *et al.*, 2017). IP logics play a pivotal role in influencing innovation by providing a framework for policymaking and incentivizing

corporate innovation (Papageorgiadis and McDonald, 2019). Below, we will concentrate on SPPO underpinned by rigorous IP logic but prior to that, we first review the literature on the role of IP logic in innovation quality of EEFs.

Innovation quality of EEFs and IP logics

Innovation encircles the process of introducing new ideas, methods, products, services or business models that ensure significant positive change, improvement or advancement (Tidd and Bessant, 2013). Innovation goes beyond inventions relating to new technical solutions; it can encompass a wide array of areas, including utility model innovation leading to incremental improvements or modifications to existing products or processes, designs protecting the ornamental or aesthetic features of products, business model innovation redefining how businesses are being operated and social innovation addressing societal challenges with novel solutions. Innovation outputs vary in quality, with innovation quality depicting the technological impact and economic value of innovation, often captured by patent forward citations (Lahiri, 2010; Trajtenberg, 1990; Zhao *et al.*, 2023). Given the definition of innovation quality, we focus on invention patents for their heightened level of novelty, non-obviousness (i.e. no obvious extension or combination of existing knowledge) and industrial applicability (Dang and Motohashi, 2015; Hu, Zhang and Zhao, 2017).

The institutional logics perspective theorizes that organizational actions are influenced by institutional logics, because isomorphic conformance can confer legitimacy and garner social support for economic success (Durand and Thornton, 2018; Meyer and Peng, 2016; Thornton, Ocasio and Lounsbury, 2012). Specific to IP logics and innovation quality, the prevailing weak IP logic in EEs, translated to the lenient standards of patent examination and enforcement, has enabled EEFs to generate a mass of inventions based on low-quality innovations (Peng *et al.*, 2017). However, market liberalization has exposed EEFs to increased competition in both domestic and international markets, and also rigorous IP logic is prevalent in DEs (Zhou, Gao and Zhao, 2017). Multiple and incompatible logics at the macro level highlight the role of agency in the specific composition of firms' innovation strategy, and hence variations of their actions (Wang *et al.*, 2022).

The emergence of different 'rules of the game' that delineate legitimate behaviours in EEs afford EEFs the opportunity of agency to identify different courses of action (Genin, Tan and Song, 2021). Instead of conformance to the prevailing weak IP logic at home, the quest for legitimacy in international competition and alleviation of the perception as IP infringers may propel some EEFs to take actions that align with rigorous IP logic to file patents in DEs (Pache and Santos, 2010). To fulfil more sophisticated requirements of patent filing and protection in DEs, EEFs must emphasize innovation quality and establish corresponding organizational routines. Moreover, they may be motivated to develop expertise in the regulatory domain to defend IP rights. Consequently, EEFs being receptive to rigorous IP logic in their technological endeavours can be expected to improve innovation quality. The key question is identifying the characteristics of these EEFs. We focus on international imprinting.

International imprinting and IP logics

The institutional logics perspective emphasizes purposeful actions of agency at individual and organizational levels (Micelotta, Lounsbury and Greenwood, 2017). This agency often arises from interactions between the entities and their previously exposed external environment (Maksimov, Wang and Luo, 2017). Institutional imprinting occurs through this interaction and socialization. During sensitive periods of substantial uncertainty and instability, entities become more receptive to new value systems and cognitive frameworks, making them malleable to environmental stimuli (Kish-Gephart and Campbell, 2015; Zhang, Zhang and Jia, 2022). The assimilation of prominent environmental features can have a lasting impact on individuals and organizations, and these imprints influence them persistently, even as external conditions change (Marquis and Tilcsik, 2013). These imprints can prompt behavioural changes by impacting information processing and focus of attention, subsequently affecting firm strategies (Marquis and Qiao, 2020; Sapienza *et al.*, 2006). Thus, the exercise of agency to incorporate the incentives afforded by specific institutional logics may depend on the imprinting of firms and their key decision-makers. We introduce the institutional imprinting perspective to complement the institutional logics perspective to understand the role of agency in strategic responses, particularly emphasizing international imprinting.

The institutional imprinting perspective stresses that sensitive periods are not limited to the founding period, encompassing special moments of time when focal entities enter a new field and/or experience role transitions that can make them more susceptible to environmental influence than ordinarily (Maksimov, Wang and Luo, 2017). A case in point is international imprinting. Following Marquis and Tilcsik's (2013) definition of imprinting, we define international imprinting as the process through which the characteristics of a foreign country's institutional environment are stamped upon an entity – whether an individual or an organization – during its sensitive or early stages of development.

Unlike international experience,[2] which emphasizes the practical knowledge gained through international exposure, international imprinting entails the deep-rooted assimilation of new values and cognitive frameworks that persist despite subsequent environmental changes (Marquis and Tilcsik, 2013). This distinction is critical: international imprinting offers a nuanced perspective on foundational experience significantly shaping how firms and their decision-makers process information and adopt institutional logics. For instance, exposure to institutional logics in DEs can profoundly imprint new norms and expectations on entities from EEs. This imprinting occurs as the entity interacts with and adapts to the distinct norms, values and practices of the foreign environment. Over time, the imprinting acts as a filter through which the entity interprets and responds to institutional demands (Tilcsik, 2014), influencing its routines and directing attention in ways that align with the internalized values and cognitive frameworks. This alignment not only shapes the entity's ongoing strategies but also ensures that its actions are consistent with the institutional logics of the environment where the imprinting occurred. Given the cross-country differences in knowledge stock and technology advancement, the location of foreign exposures during the brief period of susceptibility matters for the imprinting effect (Fu, Hou and Liu, 2018).

The magnitude of international imprinting may hinge on the economic and technological gaps between a firm's home and host countries (García-Canal *et al.*, 2018). While EEFs may venture into a variety of markets, the effect of international imprinting can be more salient in DEs given their more sophisticated institutional environment and consumer demands than EEs (Fu, Hou and Liu, 2018). For EEFs and their decision-makers, lacking knowledge and the need to catch up to technological frontiers during initial or early exposure to DEs may encourage entities to internalize the institutional norms and practices prevalent in these regions, including rigorous IP logics. Rigorous IP logics are typically found in DEs where the legal and regulatory frameworks surrounding IP are well-established and strictly enforced. The connection between international imprinting and rigorous IP logics is particularly relevant for EEFs in how they approach innovation. While there is an increasing body of literature examining the impact of imprinting of home-country institutions (e.g. Maksimov, Wang and Luo, 2017; Shirodkar, Konara and McGuire, 2017; Thakur-Wernz and Wernz, 2022) and executives' backgrounds (e.g. Marquis and Qiao, 2020; Wang, Du and Marquis, 2019; Zhang, Ren and Wu, 2023; Zhang, Zhang and Jia, 2022), research on international imprinting remains limited, with the existing literature largely overlooking the relationship between international imprinting and institutional logics. We fill the gap through complementing the institutional logics perspective with the institutional imprinting lens to depict managerial and organizational imprinting in DEs as a promotional mechanism for EEFs' agency to shape their innovation quality.

Hypothesis Development

SPPO underpinned by rigorous IP logic

State policies are intricately interwoven with prevailing societal norms, values and established ways of thinking within institutions, and thus underpinned by institutional logics. Rather than being perceived as a monolithic set of rules compelling isomorphic conformance, research grounded in the institutional logics perspective advocates accounting for the underlying logics that shape state policies (Wang *et al.*, 2022). Governments often adopt policies underpinned by competing logics concurrently to accommodate the diverse interests of stakeholders (Jandhyala, 2015; Özen and Akkemik, 2012). This phenomenon is especially evident in EEs where non-mandatory policy incentives aimed at improving economic efficiency and assisting EEFs' leapfrogging are launched on a trial-and-error basis alongside mainstream legislative frameworks (Băzăvan, 2019; Ramamurti and Hillemann, 2018).

The kernel that fosters sustainable growth of EEs and the international competitiveness of EEFs hinges on the development of fully fledged policy frameworks that promote and protect innovation (Băzăvan, 2019). The advent of market-supporting institutions, which endorse technological innovation and IP protection underpinned by rigorous IP logic, may collide with the prevailing weak IP logic incorporating state intervention that prioritizes socio-political imperatives in many EEs (Thakur-Wernz and Wernz, 2022). The coexistence of these competing logics not only mirrors the complexity of EEs undergoing transition but also underscores heterogeneous responses of EEFs in pursuing innovation (Maksimov, Wang and Luo, 2017). While EEFs may be tagged as being less innovative, the constellation of legislative frameworks and non-mandatory policies that

[2]The innovation literature has largely focused on international experience instead of international imprinting. These are two related concepts, but there are subtle differences. While international experience typically refers to the knowledge and skills gained from exposure to international markets, international imprinting goes deeper, focusing on how earlier interactions with international environments leave lasting impressions that influence values and cognitive frameworks, impacting on firms and their decision-makers. The distinction between international experience and international imprinting becomes particularly important when examining how firms respond to complex institutional logics. While international experience provides firms with current knowledge and skills, international imprinting involves a deeper, more persistent influence that affects organizational actions.

embrace competing IP logics may push some EEFs to the forefront of innovation, resulting in high-quality inventions (Wu, Lin and Wu, 2022).

Specific to R&D subsidy policies, SPPO signifies a policy initiative underpinned by rigorous IP logic, implemented by EE governments to encourage their firms engaging in high-quality innovation. It coexists with emerging economies' deficient legislative frameworks for IP protection, as the technical and regulatory criteria for the award of the subsidy go far above domestic standards. The co-existence of legislations and non-mandatory policies, such as SPPO, feature competing logics and point to the complexity of isomorphic conformance. This highlights that firms' responses to policy, alongside their underlying logics, can be central to innovation strategy. As elucidated below, firms being receptive to rigorous IP logic may echo the policy and focus on innovation quality. Specifically, SPPO awards alleviate financial constraints and induce R&D activities with an explicit focus on innovation quality (Wei and Zuo, 2018; Yi *et al.*, 2021). Firms embracing rigorous IP logic may put greater emphasis on the promotional effect of subsidies, as they indicate the government's confidence that their technological competence and future appropriability can be reaped through invention patent protection (Chen *et al.*, 2018). This symbolic effect may empower EEFs to overcome such barriers as limited track record in innovation, attract funding for risky yet groundbreaking projects and leverage networks of contacts for talent recruitment (Gao *et al.*, 2021).

H1: EEFs responding to SPPO have higher innovation quality.

International imprinting as boundary condition

While the institutional logics perspective illuminates the interplay between organizational responses and competing logics (Micelotta, Lounsbury and Greenwood, 2017), understanding what impacts firms' agency requires a more nuanced understanding. EEFs often respond variably to the incentives within the institutional frameworks (Thakur-Wernz and Wernz, 2022). Managerial and organizational international imprinting may elevate agency, aligning with policy incentives underpinned by rigorous IP logic that encourages high-quality innovation. Building upon prior research (García-Canal *et al.*, 2018; Sapienza *et al.*, 2006), we explore the moderating role of international imprinting at board and organizational levels. The BoD and foreign subsidiaries established through OFDI represent two distinct levels within the organizational structure of a firm. These levels serve distinct functions, bear differing responsibilities and operate at varying levels of decision-making within the corporate hierarchy. The BoD, comprising directors elected by the shareholders, represent their interests and oversee the management of the whole firm including their subsidiaries. As the highest governing body in a firm, the BoD possesses ultimate decision-making authority, overseeing firm strategies and goals. Foreign subsidiaries are separate legal entities controlled by parents, who typically own a majority of the subsidiaries' voting stock. While subsidiaries are responsible for implementing and executing specific aspects of the parents' strategies and have autonomy in their day-to-day operations, their major strategic decisions may necessitate approval or guidance from the parents. In view of these differences, it is plausible to anticipate that the BoD and OFDI are two distinct sources of international imprinting.

Moderating effects of the BoD's international imprinting. The BoD can be instrumental in organizational decisions, for example innovation (for reviews, see Asensio-López, Cabeza-García and González-Álvarez, 2019; Sierra-Morán *et al.*, 2024). While innovation offers firms monopolistic rents and competitive advantages, it can be costly and time-consuming (Hall and Lerner, 2010). Developing innovative ideas and bringing them to market require significant resources and time, with no guarantee of success. Innovation, therefore, simultaneously carries the opportunity for higher long-term returns for shareholders and the risk of reducing short-term management compensation. The BoD, as gatekeepers in safeguarding shareholders' interests, can exercise power and influence over firms' innovation decisions (Baysinger, Kosnik and Turk, 1991; Hillman and Dalziel, 2003; Robeson and O'Connor, 2013). Existing research has examined the role of the BoD from the perspectives of board structure (e.g. size, CEO duality, directors' equity), board demography (e.g. directors' tenure, age) and board social capital (for reviews, see Asensio-López, Cabeza-García and González-Álvarez, 2019; Sierra-Morán *et al.*, 2024). However, few studies have investigated international imprinting.

For individuals from EEs, the effort to achieve congruence with the expectations and standards of academic settings in DEs exerts a lasting impact on their values, cognitions and understanding of best practices (Bai, Tsang and Xia, 2020; Quan *et al.*, 2023). Studying abroad encompasses an 'imprinting' process, where individuals undergo socialization and interaction, exhibiting high receptivity to learning new values, skills and behaviours in a short period to ease the transition into new roles and identities in the host country (Bai, Tsang and Xia, 2020; Han *et al.*, 2019). Events during this time may be ingrained in one's value system and cognitive model, guiding subsequent behaviours and decision-making processes (Marquis and Qiao, 2020). The prevalence of free-market competition and rule of law in DEs are likely to be internalized by returnees owing to the imprinting effect of studying in these

countries. In their subsequent working environments, their values and problem-solving schema may heighten firms' responsiveness to rigorous IP logic. Therefore, a higher level of international imprinting of the BoD may augment EEFs' response to SPPO in their pursuit for innovation quality.

First, international educational exposure in DEs is pertinent to the advocacy of strong IP protection and legal enforcement. For example, the stringent scope and severe penalties for IP infringement can profoundly influence individuals' mindsets (Bai, Tsang and Xia, 2020; Han *et al.*, 2019). When faced with competing logics, as opposed to weak IP logic, rigorous IP logic would likely guide directors' decision-making processes, as accomplishing quality determines firms' competitiveness. Directors' international imprinting may strengthen EEFs' confidence in aligning with SPPO.

Second, international educational exposure in DEs not only affords directors access to cutting-edge knowledge but also allows them to meet with international talents. During this sensitive period, the pressures to learn, collaborate and compete make individuals more receptive to new value systems and ways of working, stimulating their competencies in processing complex information and seeking creative solutions (Azoulay, Liu and Stuart, 2017). This exposure may imprint on individuals' cognition, raising their expectations regarding the novelty and non-obviousness of innovation and understanding of how to disseminate innovation outcomes. Early exposure to educational settings in DEs may thus promote EEFs' responsiveness to SPPO, leveraging the symbolic effect of the subsidy award to reach investors globally, conducive to enhancing innovation quality.

H2: The BoD's international imprinting positively moderates the association of firms' response to SPPO and innovation quality.

Moderating effect of OFDI imprinting. Undertaking OFDI provides EEFs with the opportunity to improve innovation through resource exploitation, knowledge acquisition and spillover and network development in international marketplaces (for a review, see Ding, McDonald and Wei, 2021). Existing literature has discussed the role of home-country imprinting in firms' international expansion and performance (Shirodkar, Konara and McGuire, 2017; Zhou and Guillén, 2015). Sapienza et al.'s (2006) seminal work indicates that international imprinting owing to firms' initial or early entry into foreign markets can facilitate their capability and routine upgrading. However, OFDI imprinting has received less attention.

OFDI imprinting can acculturate firms to their host countries' environments (Meyer, Li and Schotter, 2020). The interaction between firms and their new environments can leave a lasting impact on their structure and processes, particularly during the early stages of international expansion, when EEFs are first exposed to practices for managing international operations (García-Canal *et al.*, 2018). During this brief, sensitive period, firms may be susceptible to environmental influence and may endeavour to achieve congruence with their new surroundings (Quan *et al.*, 2023). This influence not only shapes how firms interpret information, but also impacts how they achieve organizational goals. Rigorous IP logics in DEs may generate a stamp effect on EEFs that expand into these markets as their first step, translating these practices through interaction with host-country stakeholders. We propose that OFDI imprinting can heighten EEFs' responsiveness to policy incentives favouring sophisticated IP filing and protection, thereby elevating innovation quality.

First, exposure to the well-enforced regulatory environment and lucrative markets of DEs motivates EEFs to upgrade their innovative capabilities (Anand *et al.*, 2021; Chen *et al.*, 2023). OFDI imprinting may amplify their inclination to echo SPPO. The subsidy enables EEFs to allocate additional resources to cutting-edge technology and R&D personnel recruitment, thereby generating more high-quality innovations than EEFs lacking OFDI imprinting. Second, EEFs venturing into DEs as their initial expansion destination may face greater challenges in gaining acceptance within local business networks (Lu, Ma and Xie, 2022). OFDI imprinting can heighten their awareness of the reputational effect of their activities at home, promoting them to proactively engage with SPPO by investing in patent warning systems and developing stronger legal expertise to protect inventions.

H3: OFDI imprinting positively moderates the association of firms' response to SPPO and innovation quality.

Joint effects of the BoD's international imprinting and OFDI imprinting. The imprinting literature posits that environments are heterogeneous settings, comprising a diverse array of economic and technological conditions, institutional forces and the influence of powerful individuals (Marquis and Tilcsik, 2013). These factors coexist, influencing and potentially leaving imprints at multiple levels within an organization (Maksimov, Wang and Luo, 2017). This highlights that firms operating in complex and multidimensional spaces can carry multiple imprints (Lounsbury and Ventresca, 2002). As firms and their members are not blank slates, their allocation of attention and actions often reflects the salient characteristics of the environments where they were previously exposed. The configuration of imprints at different levels may complement or compete with each other, influencing how the firm responds to institutional complexity. Building on the preceding discussion concerning the separate moderating effects of international imprinting at board and organizational levels, we recommend that

these forces may synergize to augment the positive impact of EEFs' response to SPPO on innovation quality.

First, the stimulating role of OFDI imprinting at the organizational level can motivate directors to actively diffuse practices for IP protection that they acquired during their education in DEs. OFDI imprinting, coupled with efforts to build an image within host-county networks, prompts EEFs to consider their domestic conduct and practices. As previously discussed, international imprinting shapes the value systems and cognitive frameworks of directors. The reputational spillover of cross-border business activities may strengthen their willingness to adhere to the rules and principles ingrained through their international educational exposure. When coupled with OFDI imprinting, practices deemed appropriate – such as patent intelligence and legal competence in defending IP rights – can rapidly be introduced. This complementary effect may increase EEFs' resource commitments to pursue high-quality innovation, thereby amplifying their response to SPPO.

Second, the augmenting effect of the BoD's international imprinting may become more pronounced in the presence of OFDI imprinting. The incorporation of innovative ideas from directors' international educational exposure becomes more impactful when EEFs carry the environmental stimuli of the host country, as expectations about innovation quality may feed back into helping directors target investors and collaborators. The synergistic effect generated by imprints at board and organizational levels may increase EEFs' willingness to commit more resources to quality innovation. Consequently, EEFs can be more proactive in following SPPO.

H4: The BoD's international imprinting and OFDI imprinting jointly moderate the association of firms' response to SPPO and innovation quality.

Data and Methodology

Sample and variables

Our research context is cognate to R&D policies and innovation quality in China (see Appendix A for further discussions). China's IP regime has been reformed to align with international agreements including the Patent Cooperation Treaty (PCT), the World Intellectual Property Office (WIPO) Copyright Treaty (Hong, Edler and Massini, 2022; Peng *et al.*, 2017).[3] Specifically, we focus on SPPO and inventions by Chinese listed firms in computers, telecommunications and electronics sectors. Appendix B presents detailed information on data sources. Given the time lag between patent application and approval (the longest is 7 years in our sample) and the dependent variable being patent citations, we focus on patents filed during 2004–2015 and cited up to 2021. See Appendix B for a justification of the selected sample period. Our sample comprises an unbalanced panel of 118 firms with 1274 observations between 2004 and 2015. Table 1 summarizes the control variables and their measures. Below we present more detailed information on the main variables.

We measure the dependent variable, innovation quality (*Quality*), using patent quality, as reflected by the impact of a patent, and commonly measured by forward citations (Cumming, Peter and Tarsalewska, 2020; Trajtenberg, 1990). Appendix C provides detailed discussions on the construction of forward citations data. Quality is measured by the cumulative number of forward citations received by invention patents over a 5-year period.

To ascertain the effects of SPPO in a DiD framework, we construct three dummy variables. *Post* is used to distinguish between the periods before and after 2009 (inclusive) when SPPO was launched. Although SPPO applies universally in China, firms' responses differ. PCT applications indicate a response aligned with rigorous IP logic. *Policy* is created to identify whether a firm has responded to the SPPO. Following PSM analysis, we construct *Post_Policy*. The treatment group comprises firms that have at least one PCT application, while the control group includes firms with no applications during 2004–2015. Post_Policy is coded as 1 for treated firms after 2009, and 0 otherwise. For non-treated firms, Post_Policy is 0 throughout. As a robustness check, we construct an alternative measure where treated firms are assigned 1 for years following their first PCT application, and 0 otherwise; non-treated firms are assigned 0 throughout.

For the moderators of BoD international imprinting (*IIBL*) and OFDI imprinting (*OFDII*), we draw from prior research on institutional imprinting which encompasses both international and domestic imprinting. Institutional imprinting has been measured by considering the earlier-year experience of individuals (e.g. Bai, Tsang and Xia, 2020; Hahn, Minola and Eddleston, 2019; Wang, Du and Marquis, 2019; Zhang, Zhang and Jia, 2022), or the founding period of firms (e.g. Maksimov, Wang and Luo, 2017; Zhang, Ren and Wu, 2023).

We construct IIBL by examining directors' international educational exposure in DEs in the main analysis. Similar to Hahn, Minola and Eddleston's (2019) examination of imprinting effects of scientists' careers measured by the number of scientists on innovative start-ups' founding teams, we measure IIBL as the share of directors at headquarters who studied abroad because

[3]PCT facilitates the filing of patent applications with the aim of obtaining protection for inventions in multiple countries. Instead of filing separate applications in each desired country, applicants file a single PCT application that first undergoes an international search to identify prior art relevant to the claimed invention. Applicants then choose countries that are party to the treaty to pursue patent protection.

Table 1. Control variables and measurements

Control variable	Measurement
Size	Firm size measured by the logarithm of total sales
ROA	Firm's return on assets measured by the ratio of firm's profits to total assets
Age	Firm age measured by the number of years since establishment
Unabsorbed_Slack	Firm's unabsorbed slack measured by the ratio of cash flow and marketable securities to current liabilities
Local_Government_Subsidy	Subsidies conferred by provincial/municipal governments for PCT patents (Local_Government_Subsidy) (Wei and Zuo, 2018)
Special_Zone	Given preferential policies related to Special Economic Zone (SEZ), Economic and Technological Development Zones (ETDZ) and High-tech and Industrial Development Zones (HIDZ). We include a dummy (Special_Zone) to identify these locations
Provincial_GDP_per_capita	The logarithm of GDP per capita of the province where the firm's headquarters is located
Provincial_R&D_Expenditure	The logarithm of R&D expenditure by research institutions, universities and enterprises of the province where the firm's headquarters is located
Dynamism	The logarithm of the industry's R&D expenditure, as innovation quality may be more significant in industries characterized by rapid knowledge development and spillovers (Uotila *et al.*, 2009)

Abbreviation: R&D, research and development.

international educational experience typically occur in DEs. Given the evolving composition of the board, this variable is time-varying. As a robustness check, we consider directors' international work experience[4] and generate an alternative measure by using the share of directors with international educational and work experience. The correlation between the two measures is high (0.91).

For OFDII, inspired by Zhang, Ren and Wu's (2023) method of measuring firms' ideological imprinting, we use a dummy variable, assigning 1 to firms whose first OFDI was in a DE, and 0 otherwise. For robustness, we follow Maksimov, Wang and Luo's (2017) measure of institutional imprinting by private firm founding and use the cumulative years of first OFDI subsidiaries in DEs. The correlation between these two measures is 0.76. Contrastingly, the coefficients between different measures of IIBL and OFDII are low, ranging from 0.28 to 0.36, empirically confirming that the BoD's international imprinting and OFDI imprinting are two sources of international imprinting.

Methods

Our methodology follows the established PSM-DiD approach (for reviews, see Lee *et al.*, 2024; Stuart *et al.*, 2014; Wing, Simon and Bello-Gomez, 2018) that has been adopted by existing studies (e.g. Jia, Huang and Man Zhang, 2019; Ren *et al.*, 2023; Singh and Agrawal, 2011; Varshney, 2023).[5] We initially employ PSM to assess whether EEFs that exhibit responses to SPPO demonstrate higher innovation quality. We differentiate treatment and control groups based on whether firms have PCT patents. Firms in these two groups are comparable by matching them on key attributes including *Size*, *ROA*, *Age* and *Unabsorbed_Slack*. We estimate the average treatment effect on the treated (ATT) and apply kernel matching to estimate the difference in Quality between treatment and control groups. The acceptability of the matching results is determined when the absolute value of standard bias of each covariate is less than 10%. Additionally, a t-test is conducted on mean values of matching variables between the treatment and control groups to assess whether there is a significant difference between the two after matching. A significant ATT indicates support for H1.

To examine H2–H4, we apply PSM-DiD to the following model. Estimation is based on the sample that

[4]This is chosen as an alternative measure for robustness check because overseas work experience can occur in both developed and developing economies. Unfortunately, data on the overseas work experience of directors does not differentiate work experience in developed and developing economies. Quan et al.'s (2023) examination of CEO foreign experience considered the CEO's education and work experience in developed economies; they manually collected data from firms' annual reports and verified and supplemented this data with information from public media, including Sina Financial and Baidu. This is not feasible for our study. During our sample period of 2004–2015, out of 1238 directors with overseas experience, 655 had overseas work experience. We searched firms' annual reports and public media and could not obtain comprehensive information about overseas work experience for these 655 directors. Therefore, we focus on overseas education experience conceptually and empirically but incorporate overseas work experience into the measure for robustness check.

[5]Since Rubin's earlier work on causal inference and PSM in observational studies and quasi-experimental methods (e.g. Rosenbaum and Rubin, 1983), the DiD method has been widely used to analyse policy effects (Rubin, 1974; Stuart *et al.*, 2014; Wing *et al.*, 2018) because it allows the examination of changes in outcomes before and after the implementation of the treatment. It requires the presence of two groups (treatment and control) and multiple time periods (before and after policy implementation) and involves comparing the difference between the two differences, that is, the difference between before and after the policy and the difference between the treatment and control groups, to determine the effect of the policy intervention. Combining PSM with DiD to ensure the comparability of treatment and control groups helps to mitigate sample selection bias.

removes unmatched observations following PSM:

$$\begin{aligned} Quality_{i,t} &= \beta_1 IIBL_{i,t-1} + \beta_2 OFDII_{i,t-1} \\ &+ \beta_3 Post\_Policy + \beta_4 (Post\_Policy \times IIBL_{i,t-1}) \\ &+ \beta_5 (Post\_Policy \times OFDII_{i,t-1}) \\ &+ \beta_6 (IIBL_{i,t-1} \times OFDII_{i,t-1}) \\ &+ \beta_7 (Post\_Policy \times IIBL_{i,t-1} \times OFDII_{i,t-1}) + X_{i,t-1}\alpha \\ &+ v_{province} + u_{firm} + \delta_{year} + \gamma_{province-year} + e_{i,t-1} \end{aligned}$$

where X refers to a vector of control variables. $v_{province}$, u_{firm}, δ_{year} and $\gamma_{province\text{-}year}$ are province, firm, year and province–year fixed effects, respectively. e is an error term. We lag all time-variant explanatory variables, except Post_Policy, by 1 year to mitigate endogeneity. Additionally, lagging IIBL and OFDII helps to address the issue that their effects on innovation quality may take time to materialize.

Given that Quality is a count variable, and acknowledging the issues associated with the conditional fixed-effects negative binomial model, making it not a true fixed-effects model (Allison and Waterman, 2002), we use the fixed-effects Poisson pseudo-maximum likelihood (PPML) method with the clustered standard errors which is valid under overdispersion (Silva and Tenreyro, 2006). For robustness, two alternative matching methods – Mahalanobis distance matching (MDM) and coarsened exact matching (CEM) – are employed. See Appendix D for details.

Results

Table 2 presents descriptive statistics and correlation coefficients. Post_Policy, IIBL and OFDII exhibit positive correlation with Quality. The low correlation coefficients between key variables indicate that multicollinearity is not a concern.

We first assess H1. Table 3 presents the results of PSM. To examine the performance of the PSM method, we conduct balanced test (Table 4), standardized percentage bias across covariates (Figure 1) and kernel density functions of propensity score (Figure 2). The results indicate that the matching is acceptable, with no significant difference between the treatment and control groups concerning the covariates used in the matching exercise. We then proceed to examine the difference in ATT, which is positive and statistically significant (60.62, $p < 0.001$), indicating support for H1.

Table 5 presents regression results to test H2–H4. Model 5-1 is a benchmark model with control variables and IIBL included. Model 5-2 adds Post_Policy. The coefficient on Post_Policy is positive and statistically significant, indicating that firms responding to SPPO have higher innovation quality than non-responding firms, reinforcing support for H1. This is also confirmed in other full-sample models where the coeffi-

Table 2. Descriptive statistics and correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12
1. Quality	1											
2. Size	0.34***	1										
3. ROA	0.01	0.09***	1									
4. Age	0.03	0.17***	−0.03	1								
5. Unabsorbed_Slack	−0.02	−0.14***	0.03	−0.16***	1							
6. Local_Government_Subsidy	0.03	0.13***	0.04	0.38***	0.04	1						
7. Special_Zone	0.07*	0.08***	−0.01	0.02	−0.005	0.03	1					
8. Provincial_GDP_per_capita	0.08**	0.28***	0.06*	0.23***	0.02	0.50***	−0.003	1				
9. Provincial_R&D_Expenditure	0.11***	0.30***	0.06*	0.23***	0.13***	0.50***	0.06*	0.86***	1			
10. Post_Policy	0.13***	0.33***	0.03	0.11***	−0.02	0.48***	0.07*	0.34***	0.33***	1		
11. IIBL	0.18***	0.29***	0.01	0.002	0.06*	0.07***	0.01	0.18***	0.20***	0.07	1	
12. OFDII	0.15***	0.45***	0.02	0.09***	−0.02	0.15***	0.04	0.32***	0.38***	0.33***	0.29***	1
Mean	97.52	20.92	0.02	13.48	−0.73	2.21	0.60	10.55	15.10	0.36	0.06	0.46
Standard deviation	613.85	1.45	0.32	5.59	0.91	1.85	0.49	0.62	1.11	0.48	0.11	0.50

Note: N = 1274; *p < 0.1, **p < 0.05, ***p < 0.01.
Abbreviation: R&D, research and development.

Table 3. The results of PSM

Variable	Sample	Treatment group	Control group	Difference	S.E.	T-stat
Quality	Unmatched	169.24	6.94	162.30	34.34	4.73
	ATT	72.62	12.00	60.62	16.09	3.77
	ATU	6.96	50.30	43.34		
	ATE			52.70		

Abbreviations: ATT, average treatment effect on the treated; PSM, propensity score matching.

Table 4. Balanced test of PSM

		Mean			t-test	
Variable		Treatment group	Control group	Percentage bias	T	p > |t|
Size	Unmatched	21.25	20.40	65.3	11.50	0.000
	Matched	21.25	21.20	4.4	0.86	0.389
ROA	Unmatched	0.03	0.004	8.7	1.60	0.110
	Matched	0.03	0.02	2.3	0.94	0.346
Age	Unmatched	−0.66	−0.81	15.8	2.85	0.004
	Matched	−0.66	−0.71	4.9	1.13	0.258
Unabsorbed_Slack	Unmatched	12.77	14.48	−31.0	−5.44	0.000
	Matched	12.77	12.52	4.5	0.89	0.372

Abbreviation: PSM, propensity score matching

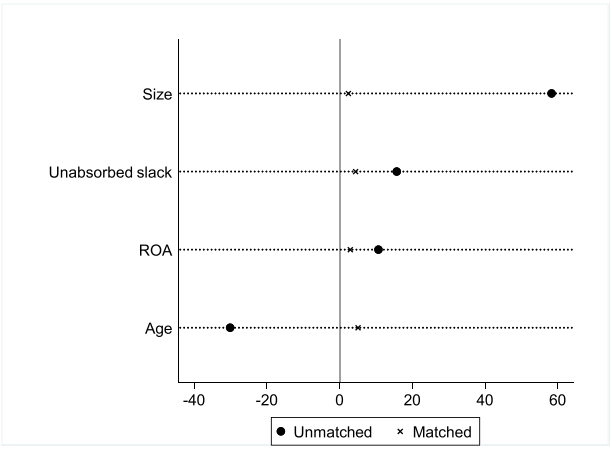

Figure 1. Standardized percentage bias across covariates

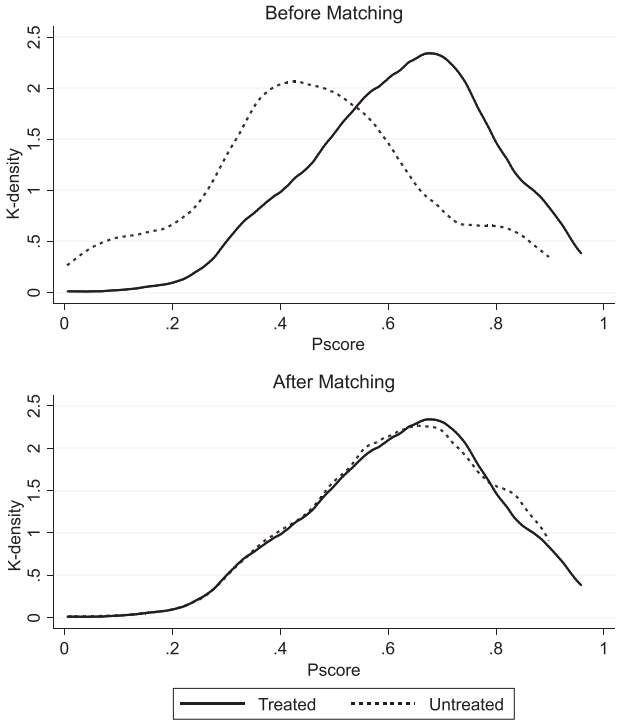

Figure 2. Kernel density functions of propensity score

cients on Post_Policy are positive, albeit having varying degrees of statistical significance. Model 5-3 introduces the interaction term between Post_Policy and IIBL (Post_Policy×IIBL), which is positive and statistically significant. For firms with a moderate level of IIBL (mean value), innovation quality increases by 186.91% following SPPO response. However, for firms with a higher level of IIBL (one standard deviation above mean), innovation quality increases by a relatively large magnitude (449.04%, an increase of 262.13%) post-SPPO response, thereby supporting H2.

Model 5-4 is a benchmark model including control variables and OFDII. Model 5-5 adds Post_Policy. Model 5-6 introduces the interaction term between Post_Policy and OFDII (Post_Policy×OFDII), which is significantly positive. For firms without OFDII, innovation quality increases by 84.04% following the SPPO response. In contrast, for firms with OFDII, innovation quality increases by a relatively large magnitude (326.31%, an increase of 242.27%) post-SPPO response, thus supporting H3.

Table 5. Effects of Post_Policy, IIBL and OFDII on innovation quality[a]

Model	5-1	5-2	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10
Sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Full sample	Subsample without OFDII	Subsample with OFDII	Full sample
Size	0.60***	0.58***	0.58***	0.77***	0.72***	0.77***	0.58***	0.27*	0.75***	0.58***
	(0.16)	(0.16)	(0.13)	(0.18)	(0.16)	(0.14)	(0.12)	(0.13)	(0.18)	(0.11)
ROA	1.93	2.46*	1.84†	2.18†	2.88*	2.42*	2.02*	2.77*	1.24	1.64†
	(1.32)	(1.33)	(1.05)	(1.13)	(1.29)	(1.18)	(1.00)	(1.25)	(1.41)	(0.88)
Age	0.23	0.17	0.07	0.22	0.15	0.12	0.09	0.04		0.11
	(0.21)	(0.20)	(0.14)	(0.19)	(0.18)	(0.15)	(0.15)	(0.17)		(0.15)
Unabsorbed_Slack	0.35***	0.33***	0.28**	0.34**	0.31**	0.28**	0.27**	0.06	0.50***	0.27**
	(0.11)	(0.10)	(0.10)	(0.12)	(0.11)	(0.10)	(0.10)	(0.16)	(0.08)	(0.10)
Local_Government_Subsidy	−0.30†	−0.22	−0.18	−0.23	−0.13	−0.09	−0.17	0.20	−0.52*	−0.12
	(0.16)	(0.15)	(0.12)	(0.15)	(0.15)	(0.14)	(0.12)	(0.21)	(0.25)	(0.14)
Provincial_GDP_per_capita	3.14	3.08	2.64	3.21	3.24	3.04	2.83	−2.17	−1.35	2.98
	(2.98)	(2.64)	(1.81)	(2.69)	(2.37)	(2.07)	(1.90)	(2.33)	(1.49)	(1.99)
Provincial_R&D Expenditure	−2.22†	−2.74*	−2.03*	−1.11	−1.99	−1.87	−1.98*	−0.23	−1.36†	−2.11*
	(1.20)	(1.08)	(0.94)	(1.48)	(1.22)	(1.17)	(0.95)	(2.35)	(0.75)	(0.96)
IIBL	2.98**	2.58**	−1.46				−1.36	−1.64	−0.40	0.46
	(0.94)	(0.96)	(0.95)				(0.95)	(1.65)	(1.32)	(0.95)
OFDII				−0.41	−0.49	−1.05*	−0.31			−0.51
				(0.31)	(0.29)	(0.44)	(0.27)			(0.44)
Post_Policy		0.91**	0.70*		1.23***	0.61†	0.77**	−0.50	0.96***	0.73*
		(0.33)	(0.30)		(0.36)	(0.35)	(0.29)	(0.37)	(0.27)	(0.35)
Post_Policy×IIBL			5.90***				5.64***	−2.69	5.45***	−3.57†
			(1.26)				(1.23)	(2.33)	(1.59)	(2.03)
Post_Policy×OFDII						0.84**				0.12
						(0.31)				(0.31)
IIBL×OFDII										−1.53*
										(1.27)
Post_Policy×IIBL×OFDII										9.19***
										(2.04)
Observations	966	966	966	966	966	966	966	412	421	966
Wald χ^2	165.14***	126.80***	175.12***	103.22***	97.33***	113.29***	174.40***	46.33***	162.29***	375.31***

Note: All models include firm, province, year and province–year fixed effects. Age is omitted in Model 5-9 because of collinearity. [a]Standard errors are in parentheses. $^{\dagger}p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Abbreviations: IIBL, BoD's international imprinting; OFDII, OFDI imprinting.

To test H4, we explore a combination of interaction terms to understand to what extent different configurations of IIBL and OFDII influence innovation quality under SPPO. We adopt two approaches. First, we estimate the full model with all interaction terms and analyse the three-way interaction term (Post_Policy×IIBL×OFDII). This approach is subject to multicollinearity associated with different interaction terms. To mitigate this, our second approach involves a split-sample analysis, where we treat OFDII as the third moderator and split the sample to examine Post_Policy×IIBL in two subsamples.

Model 5-7 adds OFDII to Model 5-3, yielding qualitatively similar results, establishing a basis for split-sample analysis. Models 5-8 and 5-9 use the sample without the occurrence of OFDI imprinting and that with the occurrence of OFDI imprinting, respectively. Post_Policy×IIBL shows statistically insignificant effects in Model 5-8, but positive and significant effects in Model 5-9. These findings suggest support for H4, that is, the positive effect of the interaction between IIBL and Post_Policy is more pronounced for firms with OFDII than for those without. Model 5-10 is the full model including all variables, where the coefficient on Post_Policy×IIBL×OFDII is positive and significant, further supporting H4.

To ensure the robustness of our findings, we conduct additional analyses, including a parallel trends test, alternative variable measures and two alternative methods (MDM and CEM). The qualitative results are consistent with our original estimates (see Appendix D).

Discussions and Conclusion

This study aims to advance our knowledge about EEFs' innovation performance, particularly focusing on innovation quality. By integrating the institutional logics and imprinting perspective, we develop a conceptual model to examine whether EEFs' responses to rigorous IP logic, exemplified by SPPO, influences innovation quality and to what extent such response is shaped by international imprinting. Using data on Chinese listed firms in computers, telecommunications and electronics sectors between 2004 and 2021, we obtained several interesting findings. First, we find evidence that firms responding to SPPO exhibit higher innovation quality. As latecomers to international competition, EEFs often rely on government support to overcome resource constraints and limited record in generating quality patents (Băzăvan, 2019). Nevertheless, the effectiveness of policy incentives hinges upon the appeal of their underlying logics in addressing firms' interests, and thus their agency to respond. Chinese firms resonate SPPO to obtain resources, enabling them to invest in R&D and compete internationally. Contrary to views that institutional complexity in EE is a cost to business operations (Newenham-Kahindi and Stevens, 2018; Wang *et al.*, 2022), we contribute to the literature by demonstrating that such complexity, particularly the conflicting IP logics, creates opportunities for EEFs to seek alternative logics of actions to improve innovation quality.

Second, we highlight the role of international imprinting in EEFs' pursuit of high-quality innovation. Our findings show that the positive impact of SPPO on innovation quality is amplified when firms possess higher levels of international imprinting at board and organizational levels. Imprinting formed through international educational exposure in DEs leads directors to internalize key environmental cues from the host countries, which, in turn, augments EEFs' receptivity to SPPO underpinned by rigorous IP logic. This imprinting shapes directors' attention allocation, thereby enhancing firms' agency to align with and benefit from policy incentives. Additionally, we find significant interaction effect between firms' incorporation of SPPO and OFDI imprinting on innovation quality, indicating the effective flow of information from foreign subsidiaries in transmitting their imprinted experiences in DEs.

Third, we reveal the combined effects of international imprinting at different levels in reinforcing EEFs' incorporation of policy incentives to improve innovation quality. The lasting influence of international imprinting on managerial behaviours is more pronounced when EEFs bear prominent environmental stimuli from their OFDI engagement in DEs. This indicates a synergistic resonance between board-level and subsidiary-level imprinting, focusing managerial attention and shaping the interpretation of external demands in augmenting firms' strategic choices, and hence performance heterogeneity. When OFDI imprinting related to best practices and resource acquisitions for R&D is recognized and endorsed by the BoD, their interaction can further boost firms' agency to echo SPPO for the pursuit of high-quality innovative outputs.

Theoretical implications

Our paper contributes to the literature on EEFs' innovation strategy in the following ways. First, our conceptual model offers a more nuanced understanding of the conditions under which agency influences firms' decision-making on innovation quality. The institutional logics perspective holds that society, as an inter-institutional system, is composed of multiple institutional orders, each encapsulating a set of assumptions about what is perceived as legitimate, how to succeed and where to focus that can influence attentions and actions of individuals and organizations (Pahnke, Katila and Eisenhardt, 2015). While research drawn from this perspective emphasizes the central role of agency in explaining firms' strategic choices (Wang *et al.*, 2022), little

attention has been given to what bolsters firms' agency when they face multiple institutional demands underpinned by conflicting logics. We address this gap by complementing the institutional logics perspective with the imprinting lens that stresses historical attributes of individuals and organizations in influencing strategic decision-making (Marquis and Tilcsik, 2013). We argue that firms' strategic choices are shaped and constrained by the interaction between the multiplicity of institutional demands and internal representations (Pache and Santos, 2010). The exercise of agency in response to diverse institutional demands depends on the historical and social positions of key organizational actors (Durand and Thornton, 2018). The process of socialization and interaction through achieving congruence with the host-country institutional environment cultivates coherent and impactful imprinting on managers regarding the standards of IP filing and protection, accelerating EEFs' receptivity to home-government policy incentives aimed at encouraging high-quality innovation. Beyond the direct effects of agency and the infusion of managerial backgrounds on strategic decision-making (Pahnke, Katila and Eisenhardt, 2015; Zhang, Zhang and Jia, 2022), our research illuminates the complementarity between institutional logics and imprinting, showing that agency can be promoted by the imprinted experiences of organizations and their key actors. Thus, we highlight the moderating role of managers' international imprinting in augmenting EEFs' pursuit of innovation quality.

Second, we respond to the call for addressing the intersection of imprints at various levels when firms confront complex environmental demands associated with conflicting logics (Marquis and Tilcsik, 2013). Our study disentangles international imprinting at two levels – the BoD and foreign subsidiaries. We underscore that aligning EEFs' historical imprints in DEs can promote EEFs' responsiveness to SPPO, enabling them to leapfrog towards technological frontiers in international competition. By delineating the effects of international imprinting from different sources, our findings indicate that the influence of international imprinting on managerial behaviours in response to innovation quality becomes more salient when EEFs bear OFDI imprinting. This extends the imprinting literature by more comprehensively capturing the ways that imprinting at different levels interacts and coordinates to shape EEFs' agency when operating under institutional complexity, thereby shedding light on the role of multilevel imprinting in firms' strategic choices.

Policy and managerial implications

This study underscores the importance of the macro–micro link between national policies and firms' responses to the institutional logics behind the policies. The laggard developmental status has made non-mandatory policies (e.g., SPPO) largely experimental besides mainstream regulatory frameworks governing IP administration and protection in EEs (Băzăvan, 2019). Our findings suggest that policy effectiveness is subject to firms' willingness to echo the underlying IP logic that shapes the policy. Therefore, the development of policy incentives concerning innovation should account for the consistency of the objectives pursued by the state and firms. Additionally, policies to help EEFs comply with international laws when competing internationally should be considered, which may boost the effectiveness of SPPO.

From a managerial standpoint, EEFs with ambition to improve competitiveness through quality innovation should consider alignment between international imprinting within the organization and the logics underpinning policies. International imprinting at the board level exerts substantial influence on firms' agency in responding to rigorous IP logic, and thus affects their innovation quality. EEFs should pay attention to the formation and structure of the BoD by lowering conflict between members with and without international educational exposure in DEs when it comes to innovation decisions. Moreover, they must consider leveraging the complementary effect of OFDI imprinting to proactively search and respond to policies that advocate high-quality innovation.

Limitations and future research

This study has several limitations that present future research opportunities. First, using DiD in a quasi-experimental, single-sector setting may limit the generalizability of findings. Although this methodology controls for time-invariant differences between treated and control groups, the results could be influenced by sector-specific factors that may not extend to other sectors, raising questions about external validity. The assumption of parallel trends, crucial in DiD, could be harder to justify in a single-sector context if treated and control groups did not follow similar trends before the intervention. Furthermore, Chinese firms within our sample may have been pushed to improve innovation quality to compete with firms in DEs, which may not be the case for other Chinese industries or similar industries in other EEs. This suggests a need for replication studies to explore generalizability. Second, Chinese Patent Law has undergone reforms, with policy incentives introduced/adjusted to encourage firms to file PCT patents to maximize their invention appropriations. Other EEs may have different experiences with their IP regimes, highlighting the opportunity to investigate policies in these contexts. Third, our study emphasizes the moderating role of international imprinting. Since firms face diverse economic, technological and institutional forces, these may generate multiple imprints on the

same organizations. Future research should explore the intersections of imprinting from heterogeneous sources in shaping firms' responsiveness to competing IP logics.

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Appendix A

Research context

Since the introduction of the Patent Law, Trademark Law and Copyright Law that constitute the foundation of China's IP regime, reforms to these legislations have been made by the Chinese government to align with international agreements including PCT (Hong, Edler and Massini, 2022; Peng *et al.*, 2017). Alongside these legislations, large-scale innovation programmes and non-mandatory policy incentives in forms of grant, reimbursement and preferential tax treatment have been developed to foster Chinese firms' patenting initiatives (Băzăvan, 2019). Government support policies, alongside increased international competition, have spurred rapid growth of patent filings by Chinese firms (Dang and Motohashi, 2015; Jiang, Shi and Jefferson, 2020). The number of China's PCT applications has leapfrogged from 276 in 1999 to 58,990 in 2019, making the country a top source of international patent applications via WIPO's PCT filing route.[6]

However, this large number in quantity does not speak for quality. Research has shown that firms may make strategic innovations that are associated with low-cost and low-quality patents to gain legitimacy in the eyes of government and to benefit from preferential policy treatments (Dang and Motohashi, 2015; Dziallas and Blind, 2019; Higham, de Rassenfosse and Jaffe, 2021; Taques *et al.*, 2021). To improve the quality of indigenous innovation and control over cutting-edge technologies in industries such as new energies, information technology and telecommunications that are of strategic importance to national competitiveness, the Chinese Ministry of Finance issued SPPO in 2009[7] that encourages Chinese firms, research institutes and government-sponsored institutions to file patents by covering the expenses of patent filing, administration and other service fees to overseas patent agencies. It targets firms taking the PCT route to file patents abroad with their applications having been accepted by CNIPA.[8]

Our empirical study focuses on the sector of computers, telecommunications and electronics. Firms in this sector have high intensity in producing inventions and show great willingness to engage in international competition. As Table A1 indicates, Chinese firms in the abovementioned sector have been amongst the top PCT applicants with 16,394 out of 71,977 applications, accounting for 22.78% of the world total in 2015. Figure A1 reveals that exports by Chinese firms in this sector experienced steady growth from US$160,112 in 2004 to US$615,667 in 2015.

Appendix B

Data sources and sample period justification

The sample was constructed using data from a number of sources. Firm-level information was obtained from the China Stock Market and Accounting Research (CSMAR) database and the WIND database. CSMAR also provides information on country of origin, education and professional background of directors. This information was cross-checked against firms' annual reports, webpages and WIND to ensure accuracy. Patent data were obtained from the database of China National Intellectual Property Administration (CNIPA) for information regarding patent applications and granting and WIPO's PATENTSCOPE database and the WIPS database of Korean Intellectual Property Office (KIPO) for both PCT and forward citations of inventions. We consulted various issues of *China Statistical Yearbook* for data on provincial GDP per capita and R&D expenditure, and various issues of *China Statistical Yearbook on Science and Technology* for industry R&D expenditure. We also manually searched information about firm locations from their annual reports and websites to find out (i) whether they locate in SEZ, ETDZ and HIDZ, and thus enjoy preferential treatment for patent filing; and (ii) whether a PCT patent has received subsidies granted by local government at the provincial/municipal level. DEs are identified following the classification of the International Monetary Fund.

Our sample is an unbalanced panel of 118 firms with 1274 observations between 2004 and 2015. We focus on

[6]https://www.wipo.int/pressroom/en/articles/2020/article_0005.html.

[7]http://www.gov.cn/govweb/gzdt/2009-10/22/content_1446164.htm and http://www.gov.cn/zwgk/2012-05/31/content_2149501.htm.

[8]State Intellectual Property Office (SIPO) was renamed CNIPA in 2018.

patents filed during 2004–2015 and cited up to 2021. This timeframe provides a reasonable window to count forward citations received by each patent. The patent approval process, entailing a comprehensive examination of the application to verify the invention's compliance with patentability criteria, experiences a time lag primarily attributed to factors inherent within the examination process.[9] In the case of PCT applications, coordination amongst multiple national/regional patent offices introduces extra complexities and further delays: truncation bias (i.e. it usually takes several years before patents begin to accrue citations and old patents tend to have a greater chance of being cited) is a known problem in studies considering forward citations (Trajtenberg, 1990).[10] To strike a balance against measurement reliability, we follow existing studies (e.g. Ebersberger, Feit and Mengis, 2023; Lahiri, 2010; Squicciarini, Dernis and Criscuolo, 2013) by counting 5-year forward citations, that is, citations received in the first 5 years from the application date.[11] Additionally, as SPPO took effect in 2009, choosing 2004 and 2015 as the start and end point for the sample ensures a relative balance of years before and after the policy's implementation (Jia, Huang and Man Zhang, 2019).

Appendix C

The identification of PCT patents and the construction of forward citations data

To identify PCT patents, we used the WIPO's PATENTSCOPE database and the KIPO's WIPS database and cross-verified data from these two databases. Before downloading PCT patents of firms, we identified the English names of the parent and subsidiaries of the Chinese listed firms from their annual reports. We also used the translation tool in WIPS by entering the Chinese names into the database to get the translated English names. A Chinese company (parent or subsidiary) name may have multiple translations; we used Python to establish a dictionary mapping Chinese and English names. Subsequently, we created collections of English names for each firm for each year and used the entire list of English names to search for PCT patents each year.

We utilized CNIPA and WIPS databases to construct forward citations data. We cross-verified between these two databases. Citations refer to all invention patents accepted by CNIPA, including PCT and non-PCT patents. Note that firms receiving SPPO for PCT applications need to first file applications with CNIPA. To assess the citation status of each invention patent in the last 5 years from the application date, we followed these steps. First, from the CNIPA database, we downloaded detailed information on invention patents granted to each Chinese listed firm (both parent and subsidiary companies) until 2015, including information on forward citations. Next, we searched WIPS for the dates of forward citations. We then used a Python program to count the number of times each patent was cited within the last 5 years from the application date. For example, if a firm whose parent and subsidiary companies together had four inventions (A, B, C, D), and if A was cited once within the last 5 years of the application date, B had two citations, C had four citations and D had no citation, innovation quality takes the value of 7 (1 + 2 + 4).

Appendix D

Robustness check

First, we conduct a parallel-trends test by using a regression model with 3-year leads and 5-year lags. By estimating a policy treatment effect for every year in the pre- and post-treatment periods, we examine whether the differential pre-treatment trends exist between the treatment and control groups. As shown in Figure A2, the coefficients of two consecutive years before pre-treatment are not significantly different from zero, indicating no differential pre-treatment trends between different groups. However, it is interesting to note the significant increases in the level of innovation quality in the fourth year ($b = 0.55$, $p < 0.1$) and the fifth year ($b = 0.60$, $p < 0.05$) after the implementation of SPPO. This result suggests that firms' reactions to the policy grow stronger in the fourth year and have kept up the momentum in the fifth year following the policy.

Second, we employ alternative measures for IIBL, OFDII and Post_Policy. The alternative measure for IIBL is the ratio of board directors who have received an education and worked in DEs; the results are presented in Models A2-1 to A2-4. The alternative measure of OFDII is the cumulative years of OFDI; the results are presented in Models A2-5 to A2-8. The alternative measure of Post_Policy takes into account that firms vary in the time of responding to SPPO and intro-

[9]These factors include the workload of patent offices, the complexity of intangible assets to be patented, multiple rounds of communication between examiners and applicants, the search for prior art (existing knowledge in the field), the examination standards and the degree of compliance with legal and procedural requirements.

[10]Trajtenberg (1990) examined a particular innovation, the computed tomography scanner (CTS), and all associated patents applied between 1972 and 1982 and citations up to 1986. They found that, for this fast-evolving technology, the average number of citations per patent dropped from 72 to 1.

[11]The application date is often used in the literature, rather than the approval date, because once a patent application is filed, it generally becomes part of the public record, even if it may or may not receive subsequent approval. This serves several purposes including demonstrating transparency in the IP system and establishing the body of prior art.

ducing DiD with multiple times; the results are shown in Models A2-9 to A2-12. All results mostly align with those presented in Table 5.

Finally, we employ two alternative matching methods to combine with DiD analyses: MDM and CEM. Despite PSM's popularity, King and Nielsen (2019) have identified its shortcomings and recommended alternative matching methods that approximate fully blocked randomization and reduce random pruning, such as MDM and CEM. MDM uses distance metrics considering multiple covariates, potentially improving balance across all covariates. Instead of matching units based on propensity scores, MDM considers the multidimensional space of covariates to determine the distance between treated and control units. The results based on the MDM-DiD analysis are presented in Models A3-1 to A3-4 of Table A3. CEM is a matching method where covariates are coarsened into groups and then exact matches are found based on these coarsened covariates. The results of CEM-DiD are presented in Models A3-5 to A3-8 of Table A3. Both sets of results are consistent with those in Table 5.

References

Allison, P. D. and R. P. Waterman (2002). 'Fixed-effects negative binomial regression models', *Sociological Methodology*, **32**, pp. 247–265.

Anand, J., G. McDermott, R. Mudambi and R. Narula (2021). 'Innovation in and from emerging economies: new insights and lessons for international business research', *Journal of International Business Studies*, **52**, pp. 545–559.

Andersson, U., À. Dasí, R. Mudambi and T. Pedersen (2016). 'Technology, innovation and knowledge: the importance of ideas and international connectivity', *Journal of World Business*, **51**, pp. 153–162.

Asensio-López, D., L. Cabeza-García and N. González-Álvarez (2019). 'Corporate governance and innovation: a theoretical review', *European Journal of Management and Business Economics*, **28**, pp. 266–284.

Azoulay, P., C. C. Liu and T. E. Stuart (2017). 'Social influence given (partially) deliberate matching: career imprints in the creation of academic entrepreneurs', *American Journal of Sociology*, **122**, pp. 1223–1271.

Bai, X., E. W. K. Tsang and W. Xia (2020). 'Domestic versus foreign listing: does a CEO's educational experience matter?', *Journal of Business Venturing*, **35**, art. 105906.

Baysinger, B. D., R. D. Kosnik and T. A. Turk (1991). 'Effects of board and ownership structure on corporate R&D strategy', *Academy of Management Journal*, **34**, pp. 205–214.

Băzăvan, A. (2019). 'Chinese government's shifting role in the national innovation system', *Technological Forecasting and Social Change*, **148**, art. 119738.

Becker, B. (2015). 'Public R&D policies and private R&D investment: a survey of the empirical evidence', *Journal of Economic Surveys*, **29**, pp. 917–942.

Bloom, N., J. Van Reenen and H. Williams (2019). 'A toolkit of policies to promote innovation', *Journal of Economic Perspectives*, **33**, pp. 163–184.

Castellacci, F. and C. M. Lie (2015). 'Do the effects of R&D tax credits vary across industries? A meta-regression analysis', *Research Policy*, **44**, pp. 819–832.

Chen, J., C. S. Heng, B. C. Y. Tan and Z. Lin (2018). 'The distinct signaling effects of R&D subsidy and non-R&D subsidy on IPO performance of IT entrepreneurial firms in China', *Research Policy*, **47**, pp. 108–120.

Chen, K., X. Liu, Y. Li and K. Linderman (2023). 'Government support and cross-border innovation: the effect of China's innovative city policy on Chinese firms' patenting in the United States', *Production and Operations Management*, **32**, pp. 1793–1811.

Corley, K. G. and D. A. Gioia (2011). 'Building theory about theory building: what constitutes a theoretical contribution?', *Academy of Management Review*, **36**, pp. 12–32.

Cumming, D., R. Peter and M. Tarsalewska (2020). 'Public-to-private buyouts and innovation', *British Journal of Management*, **31**, pp. 811–829.

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

Dimos, C. and G. Pugh (2016). 'The effectiveness of R&D subsidies: a meta-regression analysis of the evaluation literature', *Research Policy*, **45**, pp. 797–815.

Dimos, C., G. Pugh, M. Hisarciklilar, E. Talam and I. Jackson (2022). 'The relative effectiveness of R&D tax credits and R&D subsidies: a comparative meta-regression analysis', *Technovation*, **115**, art. 102450.

Ding, S., F. McDonald and Y. Wei (2021). 'Is internationalization beneficial to innovation? Evidence from a meta-analysis', *Management International Review*, **61**, pp. 469–519.

Durand, R. and P. H. Thornton (2018). 'Categorizing institutional logics, institutionalizing categories: a review of two literatures', *Academy of Management Annals*, **12**, pp. 631–658.

Dziallas, M. and K. Blind (2019). 'Innovation indicators throughout the innovation process: an extensive literature analysis', *Technovation*, **80**, pp. 3–29.

Ebersberger, B., M. Feit and H. Mengis (2023). 'International knowledge interactions and catch-up: evidence from European patent data for Chinese latecomer firms', *International Business Review*, **32**, art. 101855.

Friedland, R. and R. R. Alford (1991). 'Bringing society back in: symbols, practices, and institutional contradictions'. In W. W. Powell and P. J. Dimaggio (eds), *The New Institutionalism in Organizational Analysis*, pp. 232–263. Chicago, IL: University of Chicago Press.

Fu, X., J. Hou and X. Liu (2018). 'Unpacking the relationship between outward direct investment and innovation performance: evidence from Chinese firms', *World Development*, **102**, pp. 111–123.

Gao, Y., Y. Hu, X. Liu and H. Zhang (2021). 'Can public R&D subsidy facilitate firms' exploratory innovation? The heterogeneous effects between central and local subsidy programs', *Research Policy*, **50**, art. 104221.

García-Canal, E., M. F. Guillén, P. Fernández and N. Puig (2018). 'Imprinting and early exposure to developed international markets: the case of the new multinationals', *BRQ Business Research Quarterly*, **21**, pp. 141–152.

Genin, A. L., J. Tan and J. Song (2021). 'State governance and technological innovation in emerging economies: state-owned enterprise restructuration and institutional logic dissonance in China's high-speed train sector', *Journal of International Business Studies*, **52**, pp. 621–645.

Guo, D., Y. Guo and K. Jiang (2018). 'Governance and effects of public R&D subsidies: evidence from China', *Technovation*, **74**, pp. 18–31.

Hahn, D., T. Minola and K. A. Eddleston (2019). 'How do scientists contribute to the performance of innovative start-ups? An imprinting perspective on open innovation', *Journal of Management Studies*, **56**, pp. 895–928.

Hall, B. H. and J. Lerner (2010). 'Chapter 14 - The financing of R&D and innovation'. In B. H. Hall and N. Rosenberg (eds), *Handbook of the Economics of Innovation*, pp. 609–639. Amsterdam: Elsevier.

Han, Q., J. E. Jennings, R. J. Liu and P. D. Jennings (2019). 'Going home and helping out? Returnees as propagators of CSR in an emerging economy', *Journal of International Business Studies*, **50**, pp. 857–872.

Higham, K., G. De Rassenfosse and A. B. Jaffe (2021). 'Patent quality: towards a systematic framework for analysis and measurement', *Research Policy*, **50**, art. 104215.

Hillman, A. J. and T. Dalziel (2003). 'Boards of directors and firm performance: integrating agency and resource dependence perspectives', *Academy of Management Review*, **28**, pp. 383–396.

Hong, J., J. Edler and S. Massini (2022). 'Evolution of the Chinese intellectual property rights system: IPR law revisions and enforcement', *Management and Organization Review*, **18**, pp. 755–787.

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

Jandhyala, S. (2015). 'International and domestic dynamics of intellectual property protection', *Journal of World Business*, **50**, pp. 284–293.

Jia, N., K. G. Huang and C. Man Zhang (2019). 'Public governance, corporate governance, and firm innovation: an examination of state-owned enterprises', *Academy of Management Journal*, **62**, pp. 220–247.

Jiang, R., H. Shi and G. H. Jefferson (2020). 'Measuring China's international technology catchup', *Journal of Contemporary China*, **29**, pp. 519–534.

King, G. and R. Nielsen (2019). 'Why propensity scores should not be used for matching', *Political Analysis*, **27**, pp. 435–454.

Kish-Gephart, J. J. and J. T. Campbell (2015). 'You don't forget your roots: the influence of CEO social class background on strategic risk taking', *Academy of Management Journal*, **58**, pp. 1614–1636.

Lahiri, N. (2010). 'Geographic distribution of R&D activity: how does it affect innovation quality?', *Academy of Management Journal*, **53**, pp. 1194–1209.

Le, S. and M. Kroll (2017). 'CEO international experience: effects on strategic change and firm performance', *Journal of International Business Studies*, **48**, pp. 573–595.

Lee, K., Y. Jeong, S. Han, S. Joo, J. Park and K. Qi (2024). 'Difference-in-differences with matching methods in leadership studies: a review and practical guide', *Leadership Quarterly*, https://doi.org/10.1016/j.leaqua.2024.101813.

Liu, H. and J. H. Luo (2022). 'Legacy of ideology: the enduring effect of CEOs' socialist ideological imprint on private firms' employee-related CSR', *Journal of Business Research*, **147**, pp. 491–504.

Long, W., G. G. Tian, J. Hu and D. T. Yao (2020). 'Bearing an imprint: CEOs' early-life experience of the Great Chinese Famine and stock price crash risk', *International Review of Financial Analysis*, **70**, art. 101510.

Lounsbury, M. and M. J. Ventresca (2002). 'Social structure and organizations revisited'. In M. Lounsbury and M. J. Ventresca (eds), *Social Structure and Organizations Revisited*, pp. 3–36. Bingley: Emerald Group Publishing.

Lu, J. W., H. Ma and X. Xie (2022). 'Foreignness research in international business: major streams and future directions', *Journal of International Business Studies*, **53**, pp. 449–480.

Maksimov, V., S. L. Wang and Y. Luo (2017). 'Institutional imprinting, entrepreneurial agency, and private firm innovation in transition economies', *Journal of World Business*, **52**, pp. 854–865.

Marquis, C. and K. Y. Qiao (2020). 'Waking from Mao's dream: communist ideological imprinting and the internationalization of entrepreneurial ventures in China', *Administrative Science Quarterly*, **65**, pp. 795–830.

Marquis, C. and A. Tilcsik (2013). 'Imprinting: toward a multilevel theory', *Academy of Management Annals*, **7**, pp. 195–245.

Meyer, K. E., C. Li and A. P. J. Schotter (2020). 'Managing the MNE subsidiary: advancing a multi-level and dynamic research agenda', *Journal of International Business Studies*, **51**, pp. 538–576.

Meyer, K. E. and M. W. Peng (2016). 'Theoretical foundations of emerging economy business research', *Journal of International Business Studies*, **47**, pp. 3–22.

Micelotta, E., M. Lounsbury and R. Greenwood (2017). 'Pathways of institutional change: an integrative review and research agenda', *Journal of Management*, **43**, pp. 1885–1910.

Newenham-Kahindi, A. and C. E. Stevens (2018). 'An institutional logics approach to liability of foreignness: the case of mining MNEs in Sub-Saharan Africa', *Journal of International Business Studies*, **49**, pp. 881–901.

Özen, Ş. and K. A. Akkemik (2012). 'Does illegitimate corporate behaviour follow the forms of polity? The Turkish experience', *Journal of Management Studies*, **49**, pp. 515–537.

Pache, A.-C. and F. Santos (2010). 'When worlds collide: the internal dynamics of organizational responses to conflicting institutional demands', *Academy of Management Review*, **35**, pp. 455–476.

Pahnke, E. C., R. Katila and K. M. Eisenhardt (2015). 'Who takes you to the dance? How partners' institutional logics influence innovation in young firms', *Administrative Science Quarterly*, **60**, pp. 596–633.

Papageorgiadis, N. and F. McDonald (2019). 'Defining and measuring the institutional context of national intellectual property systems in a post-TRIPS world', *Journal of International Management*, **25**, pp. 3–18.

Peng, M. W., D. Ahlstrom, S. M. Carraher and W. Shi (2017). 'An institution-based view of global IPR history', *Journal of International Business Studies*, **48**, pp. 893–907.

Prud'homme D. (2019). 'Re-conceptualizing intellectual property regimes in international business research: foreign-friendliness paradoxes facing MNCs in China', *Journal of World Business*, **54**, pp. 399–419.

Quan, X., Y. Ke, Y. Qian and Y. Zhang (2023). 'CEO foreign experience and green innovation: evidence from China', *Journal of Business Ethics*, **182**, pp. 535–557.

Ramamurti, R. and J. Hillemann (2018). 'What is "Chinese" about Chinese multinationals?', *Journal of International Business Studies*, **49**, pp. 34–48.

Ren, S., M. Huang, D. Liu and J. Yan (2023). 'Understanding the impact of mandatory CSR disclosure on green innovation: evidence from Chinese listed firms', *British Journal of Management*, **34**, pp. 576–594.

Robeson, D. and G. C. O'Connor (2013). 'Boards of directors, innovation, and performance: an exploration at multiple levels', *Journal of Product Innovation Management*, **30**, pp. 608-625.

Rosenbaum, P. R. and D. B. Rubin (1983). 'The central role of the propensity score in observational studies for causal effects', *Biometrika*, **70**, pp. 41–55.

Rubin, D. B. (1974). 'Estimating causal effects of treatments in randomized and nonrandomized studies', *Journal of Educational Psychology*, **66**, pp. 688–701.

Rui, H. and O. Bruyaka (2021). 'Strategic network orchestration in emerging markets: China's catch-up in the high-speed train industry', *British Journal of Management*, **32**, pp. 97–123.

Sapienza, H. J., E. Autio, G. George and S. A. Zahra (2006). 'A capabilities perspective on the effects of early internationalization on firm survival and growth', *Academy of Management Review*, **31**, pp. 914–933.

Schwartz, G. and B. Clements (1999). 'Government subsidies', *Journal of Economic Surveys*, **13**, pp. 119–148.

Shankar, V. and U. Narang (2020). 'Emerging market innovations: unique and differential drivers, practitioner implications, and research agenda', *Journal of the Academy of Marketing Science*, **48**, pp. 1030–1052.

Shirodkar, V., P. Konara and S. McGuire (2017). 'Home-institutional imprinting and lobbying expenditure of foreign firms: moderating effects of experience and technological intensity', *British Journal of Management*, **28**, pp. 589–608.

Sierra-Morán, J., L. Cabeza-García, N. González-Álvarez and J. Botella (2024). 'The board of directors and firm innovation: a meta-analytical review', *BRQ Business Research Quarterly*, **27**, pp. 182–207.

Silva, J. M. C. S. and S. Tenreyro (2006). 'The log of gravity', *Review of Economics and Statistics*, **88**, pp. 641–658.
Singh, J. and A. Agrawal (2011). 'Recruiting for ideas: how firms exploit the prior inventions of new hires', *Management Science*, **57**, pp. 129–150.
Squicciarini, M., H. Dernis and C. Criscuolo (2013). 'Measuring patent quality: indicators of technological and economic value', OECD Science, Technology and Industry Working Papers No. 2013/03.
Stuart, E. A., H. A. Huskamp, K. Duckworth, J. Simmons, Z. Song, M. E. Chernew and C. L. Barry (2014). 'Using propensity scores in difference-in-differences models to estimate the effects of a policy change', *Health Services and Outcomes Research Methodology*, **14**, pp. 166–182.
Taques, F. H., M. G. López, L. F. Basso and N. Areal (2021). 'Indicators used to measure service innovation and manufacturing innovation', *Journal of Innovation & Knowledge*, **6**, pp. 11–26.
Thakur-Wernz, P. and C. Wernz (2022). 'Impact of stronger intellectual property rights regime on innovation: evidence from de alio versus de novo Indian bio-pharmaceutical firms', *Journal of Business Research*, **138**, pp. 457–473.
Thornton, P. H., W. Ocasio and M. Lounsbury (2012). *The Institutional Logics Perspective: A New Approach to Culture, Structure and Process*. New York: Oxford University Press.
Tidd, J. and J. R. Bessant (2013). *Managing Innovation: Integrating Technological, Market and Organizational Change*. Chichester: Wiley.
Tilcsik, A. (2014). 'Imprint–environment fit and performance: how organizational munificence at the time of hire affects subsequent job performance', *Administrative Science Quarterly*, **59**, pp. 639–668.
Trajtenberg, M. (1990). 'A penny for your quotes: patent citations and the value of innovations', *RAND Journal of Economics*, **21**, pp. 172–187.
Uotila, J., M. Maula, T. Keil and S. A. Zahra (2009). 'Exploration, exploitation, and financial performance: analysis of S&P 500 corporations', *Strategic Management Journal*, **30**, pp. 221–231.
Varshney, M. (2023). 'Learning-by-hiring: how do rival firms learn from focal firm's hiring', *Research Policy*, **52**, art. 104664.
Wang, D. Q., F. Du and C. Marquis (2019). 'Defending Mao's dream: how politicians' ideological imprinting affects firms' political appointment in China', *Academy of Management Journal*, **62**, pp. 1111–1136.
Wang, J. C., J. Yi, X. Zhang and M. W. Peng (2022). 'Pyramidal ownership and SOE innovation', *Journal of Management Studies*, **59**, pp. 1839–1868.
Wang, M., A. Boateng and X. P. Hua (2021a). 'More money, more honey? An examination of additionality of China's government R&D subsidies', *European Journal of Finance*, **27**, pp. 1714–1739.
Wang, Y., H. Farag and W. Ahmad (2021b). 'Corporate culture and innovation: a tale from an emerging market', *British Journal of Management*, **32**, pp. 1121–1140.
Wei, J. and Y. Zuo (2018). 'The certification effect of R&D subsidies from the central and local governments: evidence from China', *R&D Management*, **48**, pp. 615–626.
Wing, C., K. Simon and R. A. Bello-Gomez (2018). 'Designing difference in difference studies: best practices for public health policy research', *Annual Review of Public Health*, **39**, pp. 453–469.
Wu, H., J. Lin and H.-M. Wu (2022). 'Investigating the real effect of China's patent surge: new evidence from firm-level patent quality data', *Journal of Economic Behavior & Organization*, **204**, pp. 422–442.
Wu, J., C. Wang, J. Hong, P. Piperopoulos and S. Zhuo (2016). 'Internationalization and innovation performance of emerging market enterprises: the role of host-country institutional development', *Journal of World Business*, **51**, pp. 251–263.
Xu, C., Y. Xiong, Y. Sun and Y. Liu (2021). 'Genetic distance, international experience and the performance of cross-border R&D for EMNEs', *Journal of International Management*, **27**, art. 100853.
Yi, J., M. Murphree, S. Meng and S. Li (2021). 'The more the merrier? Chinese government R&D subsidies, dependence, and firm innovation performance', *Journal of Product Innovation Management*, **38**, pp. 289–310.
Zhang, L., Y. Ren and J. Wu (2023). 'Communist ideological imprinting and the transformation of state-owned enterprises', *British Journal of Management*, **34**, pp. 1062–1078.
Zhang, Z., B. Zhang and M. Jia (2022). 'The military imprint: the effect of executives' military experience on firm pollution and environmental innovation', *Leadership Quarterly*, **33**, art. 101562.
Zhao, S., D. Zeng, J. Li, K. Feng and Y. Wang (2023). 'Quantity or quality: the roles of technology and science convergence on firm innovation performance', *Technovation*, **126**, art. 102790.
Zhou, K. Z., G. Y. Gao and H. Zhao (2017). 'State ownership and firm innovation in China: an integrated view of institutional and efficiency logics', *Administrative Science Quarterly*, **62**, pp. 375–404.
Zhou, N. and M. F. Guillén (2015). 'From home country to home base: a dynamic approach to the liability of foreignness', *Strategic Management Journal*, **36**, pp. 907–917.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section at the end of the article.