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Do weak intellectual property rights regimes affect foreign multinational firms' technology exploration? The moderating role of function-related and location-related experience

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ABSTRACT

Existing literature suggests that weak intellectual property rights (IPR) regimes are not conducive to innovation intensive activities. However, evidence of technology exploration activities by multinational companies (MNCs) in emerging countries challenges this view. We address this puzzle by examining how host-country IPR regimes influence MNCs' technology exploration, distinguishing between technology-seeking (TS) and home-base augmenting (HBA) activities. Drawing on organizational experience and learning theories, we also test the moderating role of MNCs' function-related (innovation function-specific and function-generic) and location-related (host country-specific and country-generic) international experience. Using PATSTAT patent data for 91 U.S. computer and electronics firms in the period 2001–2018, we find that weaker IPR protection is associated with a higher proportion of HBA initiatives. This challenges the conventional view that strong IPR regimes are indispensable for technology exploration. Moreover, we show that MNCs with extensive function-specific experience in the host and other foreign countries better navigate diverse IPR environments, making their technology exploration activities less affected by the strength of the host-country IPR regime.

1. Introduction

In the last few decades, a prominent shift has occurred in the internationalization of research and development (R&D) activities, with emerging countries such as Brazil, Russia, India, and China becoming attractive destinations for multinational companies (MNCs) to carry out value-added R&D operations (Lewin et al., 2009; Von Zedwitz and Gassmann, 2016), historically concentrated in TRIAD nations such as Japan, Western Europe, and North America (Patel and Pavitt, 1994). This shift was driven by several factors, such as the availability of science, technology, engineering, and mathematics talent at significantly reduced costs, the opportunity to capitalize on the technological advancements in these countries and synergize with business functions already located offshore, such as manufacturing, thereby solidifying the MNCs' position in these large and untapped markets (Ambos and Ambos, 2011; Borah et al., 2019; Manning et al., 2008). MNCs have increasingly invested in technology exploration activities in emerging countries to

enhance their existing technological capabilities by acquiring, developing, and transferring technologies from these countries to their home base for integration into new products or services. Prominent examples illustrating this trend are General Electric establishing its first and largest “digital hub” outside the U.S. in Bangalore, India, marking the city as a focal point for digital innovations (General Electric, 2016), and BMW Group launching its most extensive R&D network outside Germany in China, spanning four cities – Beijing, Shanghai, Shenyang, and Nanjing (BMW Group, 2023).

However, this trend appears incongruent with research suggesting that technology exploration is unlikely in countries with weak intellectual property rights (IPR) regimes (Pisani and Ricart, 2018). The prevalent arguments maintain that high-stakes R&D investments associated with technology exploration require strong IPR regimes to ensure appropriability and secure returns on innovation (Huang, 2016; Keupp et al., 2009; Teece, 1986). Weak IPR regimes are generally viewed as sources of uncertainty (Czarnitzki et al., 2015; Mavroudi et al., 2023),

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whereby firms tend to “make limited or toehold investments” (Phene et al., 2012, p.761). The apparent contradiction between the growing presence of MNCs' technology exploration initiatives in emerging countries and the theoretical expectation that weak IPR environments deter such activities suggests a partial understanding of how and why IPR regimes shape MNCs' technology exploration activities.

Two key gaps in the literature have contributed to this ambiguity. First, the literature does not differentiate between the types of technology exploration and their sensitivity to IPR regimes. Technology exploration can be categorized into (a) technology-seeking (TS), which aims to acquire novel knowledge to compensate for technological weaknesses in the home country, and (b) home-base augmenting (HBA), entails exploratory R&D that extends and enriches the firm's existing technological capabilities by integrating locally generated knowledge with its core competencies at home (Patel and Vega, 1999). While both represent technology exploration, HBA is more incremental and path-dependent, whereas TS involves a more radical and externally oriented search. Anchoring institutional economics (e.g., North, 1991), specifically considering IPR regimes as formal institutions that protect organizations' intellectual property (IP), this study investigates the distinct impact of host-country IPR regimes on these two forms of technology exploration in MNCs – TS and HBA – and addresses the first research question: *RQ1. To what extent does the host country IPR regime affect MNCs' technology exploration activities, specifically technology-seeking and home-base augmenting?*

Second, some MNCs may possess capabilities that help mitigate the adverse effects of host-country IPR regimes, such as experiential learning (Kolb, 2014) built through international activities, enabling them to pursue technology exploration in such environments. MNCs with international experience built on foreign direct investments (FDI) for R&D, as well as other business functions, develop a deeper understanding of local institutions and devise strategies to address institutional differences (Borah et al., 2023b; Perkins, 2014; Putzhammer et al., 2018). While organizational learning is well-studied in research addressing institutional challenges, its role in mitigating IPR regimes' impact on technology exploration and the type of experience that matters, remains unexplored. Building on the organizational experience and learning literature (Hitt et al., 2005; Perkins, 2014; Thakur-Wernz and Samant, 2019), we address this gap by formulating a second research question to examine the moderating role of MNCs' international experience across two dimensions: function and location. In relation to function-related international experience of MNCs, we distinguish between *function-specific* experience (i.e., innovation experience in our study) and *function-generic* experience (i.e., experience in activities other than innovation such as manufacturing, sales, or marketing). We also consider two forms of location-related experience of MNCs: *country-specific* experience (i.e., experience gained in the focal host country) and *country-generic* experience (i.e., experience gained in any other foreign country). *RQ2. To what extent do function-related and location-related experience in MNCs moderate the impact of the host country's IPR regime on MNCs' technology exploration activities, specifically technology-seeking and home-base augmenting?*

To address these two research questions, we use PATSTAT patent data and build revealed technology advantage (RTA) indexes (Patel and Vega, 1999) to calculate the proportion of TS and HBA activities of 91 US public firms in the computer and electronics products manufacturing sector (NAICS 334) from 2001 to 2018 across 48 host countries.

This study provides a multifaceted contribution to the internationalization of innovation research. It provides nuanced insights into how a host country's IPR regime affects the two types of technology exploration, TS and HBA, differently, which previous literature has not addressed, and, by doing so, we clarify the conceptual differences between TS and HBA and provide empirical evidence demonstrating that each responds differently to host-country IPR conditions. Contrary to prevailing assumptions, our findings show that MNCs actually favour weak IPR regimes when conducting HBA. This challenges the commonly

held view that strengthening IPR systems is always the most effective strategy for emerging countries seeking to attract innovation-related FDI, thus providing insights to scholars, managers and policymakers. Furthermore, the research advances understanding of organizational learning and experience within MNCs by distinguishing between functional and locational dimensions. It highlights that, while IPR conditions remain relevant, the ability to leverage accumulated functional and locational experience is crucial for successful HBA. MNCs with greater experience are less constrained by the host country's IPR regime when engaging in HBA activities.

The remainder of this paper is organized as follows. The next section presents a comprehensive review of the literature on the core concepts of our study – technology exploration and IPR regimes, based on which, in the following sections, hypotheses are formulated. We then discuss the data and methods and present our results. The paper concludes with a discussion of the findings, research and practical implications.

2. Background and hypotheses

Two streams of literature inform our study and hypotheses: the technology exploration activities of MNCs and the nature of IPR regimes. We begin by defining technology exploration activities and highlighting the conceptual differences among different types of technology exploration. We then review the literature on the institutional determinants of MNCs' technology exploration in host countries. Drawing on institutional economics, we focus on the host countries' IPR regimes as an institutional determinant of these activities and identify the resulting research gap. This discussion provides the foundation for the hypotheses presented later in this section.

2.1. Technology exploration activities of MNCs

Research on R&D internationalization by large MNCs traces back to several decades (e.g., Kenney and Florida, 1994; Lall, 1979; Lewin et al., 2009; Pearce, 1999). Particularly relevant to our study is the work of Kuemmerle (1999), who identified two main types of R&D conducted by MNCs abroad: technology exploration and exploitation.¹ Technology exploration, also called competence-creating, knowledge-seeking, and asset-augmenting subsidiary mandates (Ambos and Ambos, 2011; Cantwell and Mudambi, 2005), entails setting up R&D subsidiaries overseas to augment MNCs' existing knowledge by transferring the new knowledge developed by the subsidiaries back to their home base and integrating it to develop new products or services (Cantwell et al., 2004; Kuemmerle, 1999).

Scholars have also categorized technology exploration activities. Patel and Vega (1999) used the revealed technological advantage (RTA) index to assess the comparative strength of a firm in a specific technology field within its home country and host country and identified two distinct technology exploration activities: technology-seeking (TS) and home-base augmenting (HBA). TS refers to MNCs “expanding abroad in search of capabilities that are not available in their home markets” (Chung and Alcácer, 2002, p.1534) and is adopted when the host country has significantly more expertise in a specific technological field compared to the home country (Almeida and Phene, 2004; Patel and Vega, 1999). For example, a Finnish pharmaceutical MNC establishing a subsidiary in China to understand compounds used in traditional Chinese medicines and expand the drug discovery process can be labelled as TS because the home country (Finland) does not have expertise in Chinese medicines, whereas the host country (China) does.

On the other hand, HBA is adopted when a company possesses strong

¹ Technology exploitation concerns exploiting technological advantages developed in a MNC's home country, including adapting products, services and production processes to meet the needs of overseas markets (Ambos and Ambos, 2011; Kuemmerle, 1999).

technological competencies at home and seeks to further extend and enrich these capabilities through interaction with advanced knowledge bases in host countries (Laurens et al., 2015; Le Bas and Sierra, 2002; Patel and Vega, 1999). This approach enables firms to combine knowledge from both home and host locations, thereby strengthening their global innovation capabilities. This could be the case for a Taiwan-based electronics company establishing an R&D centre in Japan to create synergies in new product development in electronics. This can be labelled HBA since both Taiwan (home country) and Japan (host country) have strong innovation capabilities in electronics.

Following Patel and Vega (1999) and Cantwell and Mudambi (2005), we conceptualize HBA as a competence-creating form of exploration that is path-dependent and anchored in the firm's existing technological trajectory. Unlike technology exploitation (Kuemmerle, 1999), which adapts and deploys established knowledge to local markets, HBA involves recombining home and host knowledge to extend the firm's technological frontier. This distinction matters empirically because HBA is measured via relative firm-level technological advantage at home and in the host, capturing augmentation rather than deployment.

2.2. IPR regimes and technology exploration activities of MNCs

Institutional economics (e.g., North, 1991) posits that formal and informal institutions shape company strategies within a country. Formal institutions include codified rules, such as political, economic, regulatory, and legal frameworks, while informal institutions encompass customs, culture and religious norms (Borah et al., 2023b). For MNCs, home-country institutions influence headquarters' strategies, whereas host-country institutions guide subsidiary-level decisions (Kostova et al., 2008). These institutions affect various aspects of R&D internationalization, including location choices (Du et al., 2022), productivity (Higón and Antolín, 2012), entrepreneurial orientation (Williams and Lee, 2009), IP management (Keupp et al., 2009; Petricevic and Teece, 2019; Yang et al., 2004), workforce management (Borah et al., 2023b), and R&D collaborations (Choi and Contractor, 2016).²

Although limited, research has studied institutional determinants of technology exploration. Kuemmerle (1999) argues that MNCs are more likely to pursue exploration-driven R&D in host countries with strong knowledge bases and large talent pools. Ambos and Ambos (2011) further study the role of host country factors such as technological advantage, R&D spending, and education quality in knowledge-seeking pursuits. Similarly, Veliyath and Sambharya (2011) find that technology exploration is driven by a country's technological infrastructure and skills development. Overall, countries' specialization in certain industries, or "(neo) techno-nationalism" (Petricevic and Teece, 2019), encourages MNCs to explore technologies in those sectors. Certainly, in the early 2000s, India's expertise in IT and Software, China's growing advanced capabilities in Communication Technology and Russia's prowess in aerospace lured MNCs operating within these industries to pursue knowledge augmentation (Kenney et al., 2013; Peng and Wang,

² In this paper we refer mainly to the "old" view of institutional theory (North, 1991), which focuses on national institutions to create a conceptual setting or "country institutional profile" (Kostova et al., 2008) which aligns with the patent-based empirical analysis of our study. However, we would like to acknowledge that new institutional theory (e.g., Phillips and Tracey, 2009) recognizes the importance of fields that are defined in terms of industry norms and practices, and that cut across geographical boundaries, and therefore constitute a key dimension to guide FDI decisions and innovation processes, independent of IPR regimes. Although these aspects are very important for conceptual and qualitative research, we anchor our study to the "old" institutional theory because we examine how national IPR regimes influence the location of exploration activities but are not able to examine decision-making processes or refer to different industry norms and practices due to our focus on a single industrial sector. We are grateful to an anonymous reviewer for highlighting this issue which is worth considering in future research.

2000).

IPR regimes are formal institutions that protect organizations' IP, including patents, copyrights, trademarks, and trade secrets. Although there is a trend toward harmonizing IPR regimes, their strength still varies across countries, leading to different costs for companies enforcing IPR. Papageorgiadis and Sofka (2020) identify three types of costs: a) servicing costs, associated with familiarization with the IPR system, b) IP protection costs, incurred in applying for and maintaining IP rights, and c) monitoring costs, related to detecting IP violations and improving the IPR system through lobbying and public awareness campaigns. Based on IPR strength, Papageorgiadis et al. (2014) classify 49 countries into five groups, ranging from very strong (e.g., Nordic countries, New Zealand) to very weak IPR regimes (e.g., China, India, Russia). Broader terms such as "strong" and "weak" IPR regimes are commonly used to describe differences in IPR strength across countries (Borah et al., 2023b; Keupp et al., 2009; Mavroudi et al., 2023).

Few studies have examined the nexus between IPR regimes and firms' technology exploration activities. Athreye et al. (2016) show that in host countries with strong IPR regimes, MNCs rely less on sourcing knowledge locally and instead transfer knowledge produced at home. However, this study only examined the impact of IPR on the knowledge-sourcing process, that is, whether an MNC seeks knowledge from host country organizations, without distinguishing what the sourced knowledge was used for. Pisani and Ricart (2018) find a positive relationship between the IPR regime and knowledge augmentation, but their "Home-base knowledge augmentation" variable does not distinguish between TS and HBA. The variable is based on survey questions about selecting a location for local talent availability and expertise (Pisani and Ricart, 2018), diverging from standard measures that consider technological strengths or weaknesses in the host and home countries (Laurens et al., 2015; Le Bas and Sierra, 2002; Patel and Vega, 1999). Addressing this research gap and building on institutional economics and the conceptual and substantive differences between TS and HBA, we develop separate hypotheses on the relationship between the strength of the host-country IPR regime and the two technology exploration initiatives, TS and HBA.

2.3. Hypotheses

2.3.1. Host-country IPR regime and MNCs' technology exploration

A central distinction between TS and HBA lies in their respective levels of "technological distance" (Aharonson and Schilling, 2016), defined as the extent to which an MNC understands the functionality, application, and value appropriation of the technology sourced from the host country. TS is characterized by high technological distance, as the MNC lacks expertise in the relevant domain and seeks technologies abroad to compensate for gaps in its home-country capabilities. In contrast, HBA involves low technological distance because the MNC is already proficient in the technological area and aims to build upon its existing strengths. This variation in technological distance has direct implications for the level of investment required to bridge high technological distance and, consequently, for the type of host-country IPR regime that MNCs may prefer.

A second important dimension differentiating TS and HBA is "innovation speed" (Markman et al., 2005). Innovation speed refers to the pace at which new products or services can be developed through the exploration process. TS requires firms to understand unfamiliar technologies, assess their potential, and evaluate their integration feasibility, consequently, the innovation process might require additional time to accommodate these activities, and resulting in slow, iterative tasks, and substantial trial-and-error learning (Rerup and Feldman, 2011; Yang and Steensma, 2014). By contrast, HBA supports faster knowledge augmentation, as MNCs already possess the expertise needed to evaluate the technology, identify suitable partners, and integrate new knowledge efficiently. This difference in innovation speed shapes how MNCs benefit from, and respond to, the strength of host-country IPR regimes.

Host-country IPR regime and MNCs' technology-seeking (TS) activities

Given the greater technological distance, TS often entails a series of complex and resource-intensive activities beginning with identifying potential emerging technologies, evaluating their feasibility, and determining which ones warrant further investigation (Laursen et al., 2010). This selection process requires deep insight into the technological landscape, market conditions, and future trends (Wicki and Hansen, 2019). After identifying promising technologies, MNCs may acquire them externally from the host country or develop them internally (Laursen et al., 2010). According to Yang and Steensma (2014, p.1497), “successful exploration occurs when a firm integrates knowledge into its current innovation from beyond the realm of its existing expertise”. Integrating unfamiliar technologies into existing processes often requires further investment, including training incumbent employees to work with the new knowledge (Kim and Lee, 2022). In weak IPR environments, however, employees who receive such training can more easily leave the firm and disclose proprietary information, as they are less constrained by mobility restrictions or non-disclosure agreements (Berry, 2017; Lamin and Ramos, 2016; Von Zedtwitz et al., 2007). Such risks can be highly detrimental to MNCs undertaking TS, given the substantial sunk costs involved in training and integration (Borah et al., 2019; Borah et al., 2023b). For these reasons, MNCs are likely to prefer strong IPR regimes when engaging in TS, as they offer greater assurance of value appropriation.

Establishing strong relationships with local actors in the host country is crucial for MNCs to bridge technological distance and enable effective TS. Since the technology is new to the firm, the process often involves a trial-and-error approach (Yang and Steensma, 2014), which may require collaborative and portfolio experimentation, and networks with a wide range of potential partners (Borah et al., 2023a) to identify those with the highest level of expertise in the target technology and the capacity to provide meaningful support (Emden et al., 2006). Nambisan (2013) illustrates how U.S. telecommunications firms participate in technical committees within industry associations to explore technologies outside their core competencies. Similarly, Li (2021) highlights the value of “interlocks” — strategic connections between executives and board members — in fostering such technological exploration. This process requires time, investment and a non-negligible chance of knowledge leakage to these actors in the host country. Even after identifying a suitable partner, an MNC may need to determine how the technology fits within its existing product or technology portfolio (Bannert and Tschirky, 2004). This often involves exposing the partner organization to the MNC's broader knowledge base including high-value parent firm knowledge (Berry, 2017); consequently, additional protections may be required for technologies in which the MNC is proficient but the host country lacks expertise.

Finally, TS is characterized by slower innovation speed relative to HBA, given the extended period required for exploration, trial-and-error learning, and understanding technologies unfamiliar to the firm. This lengthy and uncertain process means that weak IPR regimes do not offer meaningful advantages in terms of speed, since the bottleneck in TS lies not in accessing talent or spillovers but in the firm's limited ability to rapidly interpret, absorb, and integrate unfamiliar knowledge. Although weak IPR environments can facilitate hiring from competitors or accessing spillovers more easily (Borah et al., 2023b), such mechanisms do not accelerate TS because incumbent employees lack “absorptive capacity” (Cohen and Levinthal, 1990), in the new domain and must first build foundational understanding before they can effectively apply externally sourced knowledge. Consequently, firms cannot quickly benefit from spillovers that remain opaque without prior expertise and may even face increased risks of misaligned or misinterpreted knowledge inputs. Hence, we hypothesize:

H1a. *An MNC is more likely to engage in TS activities in host countries with strong IPR regimes than in countries with weak IPR regimes.*

Host-country IPR regime and MNCs' Home-base augmenting (HBA)

activities.

Compared to TS, HBA presents low technological distance, requiring fewer resources and less time to integrate the new knowledge into the firm's existing products and services, reducing the need for a more robust IPR regime to safeguard investments, as the costs associated with developing or incorporating the technology are relatively modest.

Due to low technology distance, MNCs engaged in HBA typically have clear knowledge of which partners to collaborate with, enabling more targeted and efficient alliances. These focused collaborations reduce the risk of unintended knowledge spillovers, as the MNC does not need to expose its broader technology portfolio to extensive trial-and-error processes. HBA also relies on learning-by-hiring, but the knowledge transfer between new hires and incumbent R&D employees occurs more efficiently due to the latter's high competence in the relevant technology. With strong absorptive capacity (Cohen and Levinthal, 1990; Schleimer and Pedersen, 2013), the subsidiary can recognize, assimilate, and apply new knowledge quickly. Even if new hires depart shortly after joining, the firm is less affected because integration is swift and does not require revealing sensitive technological knowledge (Borah et al., 2023b).

In HBA, the focus is often on innovation speed or “clockspeed” (Nadkarni and Narayanan, 2007) — the speed at which the firm can enhance its innovation performance in a technological domain where both the MNC and the host country have expertise. This rapid knowledge augmentation is critical for achieving a first-mover advantage in the market (López and Roberts, 2002). We argue that weaker IPR regimes can provide unique benefits to HBA. For instance, in countries with weak IPR regimes, MNCs may hire R&D employees from competitors and quickly capitalize on their expertise (Belderbos et al., 2021; Von Zedtwitz et al., 2007) and spillovers (Yoo and Reimann, 2017). The weak legal enforcement of non-compete and non-solicitation agreements in such countries, compounded by slow and often corrupt judicial systems, reduces the likelihood of legal repercussions (Lamin and Ramos, 2016). As a result, firms face fewer constraints when recruiting talent from competitors, and employees feel freer to move across organizations without fear of legal sanctions (Borah et al., 2023b). This combination creates an environment where knowledge circulates more fluidly, enabling MNCs to absorb relevant expertise at a much faster pace. For HBA, where rapid knowledge augmentation is essential, this legal and institutional laxity can therefore operate as a strategic advantage by accelerating access to specialized skills and tacit technological know-how. Hence, we hypothesize:

H1b. *An MNC is more likely to engage in HBA activities in host countries with weak IPR regimes than in countries with strong IPR regimes.*

2.3.2. The moderating role of MNCs' international experience

Research demonstrates that prior international experience and learning strengthen an MNC's understanding of the technological capabilities, market conditions, and institutional norms and values of its host country (Casillas and Moreno-Menéndez, 2014; Thakur-Wernz and Samant, 2019). Such learning is primarily experiential, that is, firms gain knowledge through direct involvement in international operations. Moreover, MNCs learn from other organizations operating within the same institutional boundaries, a process known as vicarious learning (Hitt et al., 2005; Li, 2021; Manz and Sims Jr, 1981). This learning can occur through observation, such as benchmarking, as well as active participation, such as by collaborating with local firms (Bruneel et al., 2010; Li et al., 2023).

In this study, we conceptualize MNCs' international experience along two key dimensions. The first dimension concerns the functional scope, distinguishing between *function-specific* experience, which in this context refers to innovation-related experience, and *function-generic* experience, which encompasses broader operational experience in areas other than innovation, including manufacturing, sales, marketing, finance, distribution, and corporate social responsibility. The second

dimension concerns the locational scope, differentiating between country-specific experience, which refers to experience acquired within the host country, and country-generic experience, which captures experience accumulated in other international markets. These two dimensions interact to shape how MNCs interpret and respond to the host country's IPR regime when pursuing technology exploration.

The interaction between these two dimensions produces four distinct combinations of international experience that influence MNCs' technology exploration activities: a) function-specific and country-specific experience, which represents innovation experience gained in the host country, b) function-specific and country-generic experience, which captures innovation experience accumulated in other foreign markets, c) function-generic and country-specific experience, which reflects non-innovation experience in the host country, and d) function-generic and country-generic experience, which refers to non-innovation experience gained in other foreign markets. Collectively, these four combinations provide a comprehensive representation of the breadth and depth of an MNC's accumulated knowledge and shape the firm's ability to assess risks, interpret institutional differences, and adjust its technology exploration activities under varying IPR conditions.

Existing research has primarily emphasized the benefits of host-country experience for firms' strategic decision-making abroad. While some studies have considered variations in international experience based on geographic scope (Le and Kroll, 2017; Perkins, 2014), the functional dimension has received comparatively less attention. To our knowledge, no prior research has examined how country-specific and country-generic experience, in combination with functional differentiation, jointly influence MNCs' technology exploration. Addressing this gap, we develop hypotheses that integrate both functional and locational dimensions of international experience.

As outlined in H1a and H1b, MNCs may avoid TS activities in weak IPR environments and HBA activities in strong IPR environments due to the knowledge risks and legal constraints associated with these institutional conditions. In H2a, H2b, H2c and H2d, we argue that accumulated international experience across the four combinations described above

mitigates these dependencies. Table 1 presents a synthesis of these four combinations and the conceptual framework of international experience employed in this study.

Function-specific and country-specific experience of MNCs

MNCs' innovation-function-specific and host-country-specific experience provides fine-grained knowledge of the technological, institutional, and relational context within a host country's innovation system. Such learning can assist MNCs in engaging in TS in several ways. First, through sustained innovation activities, MNCs identify trustworthy local partners, often familiar from prior collaborations, including exploitation-oriented projects (Veer et al., 2016) or other business relationships (Borah et al., 2021; Borah et al., 2023a). Working with reliable partners reduces risks of knowledge leakage, encouraging firms to share core technologies even in environments with weak IPR protection, facilitating TS activities.

Second, host-country-specific innovation experience strengthens firms' ability to interpret and adapt to the idiosyncrasies of local IPR systems. This includes understanding registration procedures, protection requirements, and designing context-specific IP strategies (Keupp et al., 2012; Putzhammer et al., 2018). For instance, a technology patentable in a firm's home country may not qualify under host-country regulations. In India, product patents in pharmaceuticals, agrochemicals, and food were prohibited under the 1970 Patent Act until 2005 amendments (Godinho and Ferreira, 2012). Institutional learning of this kind enables MNCs to protect technologies that are hard to patent and to mitigate exposure during TS collaborations. Third, experience in local partnerships helps firms manage IP ownership negotiations and safeguard both "background" and "foreground" knowledge (Borah and Ellwood, 2022; Hagedoorn, 2002), particularly in weak IPR regimes.

When operating in strong IPR regimes, host-country-specific innovation experience also supports the design of effective HBA activities. Repeated engagement in R&D activities familiarizes firms with local regulations governing employee mobility, non-compete clauses, and trade secret protections (Borah et al., 2023b). MNCs learn to navigate these legal boundaries and to develop recruitment approaches that minimize infringement risks while accessing highly skilled personnel (Marx, 2022). For instance, experienced firms can distinguish between industries or firms that rigorously enforce non-compete agreements and those that do not adopt an "IP toughness strategy" (Agarwal et al., 2009). Moreover, subnational variation in enforcement, for example, the non-recognition of non-compete clauses in California (Marx et al., 2015), can be leveraged through geographically targeted hiring strategies. Over time, firms with localized innovation experience become less constrained by formal IPR rules and more capable of exploiting the local labor market for knowledge augmentation, that is their decisions to pursue TS and HBA activities in host countries, are no longer affected by the strength of host-country IPR regime. Hence, we hypothesize:

H2a. *MNCs' function-specific (innovation) and host-country-specific experience moderates the relationship between the host-country IPR regime and MNCs' TS and HBA activities, such that the more experienced the MNC, the less the strength of the host country's IPR regime affects the MNC's engagement in TS and HBA.*

Function-specific and country-generic experience of MNCs

MNCs also benefit from function-specific country-generic experience, gained through innovation activities across multiple foreign markets. This experience allows firms to codify lessons from diverse institutional environments, developing both institutional learning and flexibility (Le and Kroll, 2017; Perkins, 2014). Exposure to homogeneous IPR regimes, those with similar levels of transparency, enforcement, and legal predictability, enables MNCs to transfer best practices or "institutional templates" (Regnér and Edman, 2014) across comparable contexts. Experience in one developed economy, for instance, often translates effectively to others with similar institutional characteristics (Li and Meyer, 2009). Firms learn what mechanisms for IP protection and collaboration work best and this facilitates the application of proven

Table 1
Visualization of types of MNCs' international experience considered in this study.

		Location-related experience	
Function-related experience	Function-specific experience	<p>Country-specific experience Moderator: "Function-specific and country-specific experience of MNCs"</p> <p>Definition: MNCs' innovation experience in the host country</p> <p>Hypothesis: H2a</p> <p>Moderator: "Function-generic and country-specific experience of MNCs"</p>	<p>Country-generic experience Moderator: "Function-specific and country-generic experience of MNCs"</p> <p>Definition: MNCs' innovation experience in any other foreign country</p> <p>Hypothesis: H2b</p> <p>Moderator: "Function-generic and country-generic experience of MNCs"</p>
	Function-generic experience	<p>Definition: MNCs' experience in any non-innovation business function, including but not limited to, manufacturing, marketing and sales, in the host country</p> <p>Hypothesis: H2c</p>	<p>Definition: MNCs' experience in any non-innovation business function, including but not limited to, manufacturing, marketing and sales, in any other foreign country</p> <p>Hypothesis: H2d</p>

routines when operating in countries with similar institutional profiles (Perkins, 2014). Specifically, when pursuing TS in weak IPR regimes, experience in similar contexts helps firms apply proven informal or de-facto protection mechanisms such as secrecy, selective disclosure, or relationship-based lobbying (Keupp et al., 2009), enabling them to share technologies safely while collaborating for TS with local partners. Conversely, in strong IPR regimes, prior experience helps firms identify legitimate channels to access external knowledge and talent, such as understanding variations in non-compete or trade secret enforcement, thus encouraging MNCs to practise HBA.

Also, experience across heterogeneous IPR regimes, spanning both strong and weak enforcement systems, cultivates broader learning (Le and Kroll, 2017; Mavroudi et al., 2023). While institutional templates cannot always be directly transferred across dissimilar environments (Ambos and Ambos, 2009), subsidiaries learn to selectively retain, modify, or abandon elements of past practices (Clark and Lengnick-Hall, 2012). This exposure to diverse institutional realities develops a comparative understanding of how IP protection mechanisms operate in practice and learn to adaptively combine formal and informal approaches. This flexibility is especially useful in countries where IPR laws are evolving, and where formal rules resemble strong IPR systems, but enforcement remains inconsistent (Hong et al., 2022). In such settings, firms can combine elements from both institutional types to align with local enforcement realities. This benefits both HBA and TS activities. Hence, we hypothesize:

H2b. *MNCs' function-specific (innovation) and country-generic experience moderates the relationship between the host-country IPR regime and MNCs' TS and HBA activities, such that the more experienced the MNC, the less the strength of the host country's IPR regime affects the MNC's engagement in TS and HBA.*

Function-generic and country-specific experience of MNCs

MNCs can also benefit significantly from function-generic and country-specific experience when pursuing technology exploration in host countries. Such experience arises from operating subsidiaries engaged in business functions beyond R&D, including sales, marketing, and manufacturing, within the host country. These experiences support cross-functional learning (Athreye et al., 2016) by providing opportunities for knowledge transfer between different organizational units and by expanding firms' institutional understanding beyond the confines of innovation activities.

Research shows that subsidiaries not initially focused on R&D can gradually develop capabilities for innovative activity through accumulated functional experience. Lim et al. (2017) demonstrate how a sales subsidiary transformed into an innovation-driven unit over twelve years by first serving as a knowledge broker between local customers and headquarters and later conducting independent local innovation. Similarly, exploitation-oriented subsidiaries often evolve into exploration-oriented ones through progressive learning about local markets and institutions (Ambos and Ambos, 2011; Guimón and Salazar-Elena, 2015). Thus, function-generic experience contributes to the development of knowledge that supports innovation-related decision-making even when it does not originate from R&D activities directly.

Engagement in non-innovation functions exposes MNCs to various aspects of host-country institutional environments, including IPR regulations, administrative mechanisms and judiciary. For example, marketing or sales units may handle issues related to trademark or copyright protection, gaining insights into the judicial and regulatory processes of the host country (Yang, 2005). Although these experiences are not directly related to patenting, they still provide procedural and legal knowledge (Yang et al., 2004) valuable for managing innovation collaborations. Such exposure helps firms learn how regulatory bodies operate in practice, how conflicts are adjudicated, and how local firms interpret and respond to formal institutional constraints (Brander et al., 2017). This learning is particularly useful for TS activities in host countries, where R&D subsidiaries can apply insights gained from other

units to design effective collaboration governance structures and mitigate opportunistic behavior. For example, knowledge from manufacturing subsidiaries about local supplier relationships or contract enforcement can help R&D teams design more reliable technology partnerships and protect against knowledge leakage.

Function-generic experience in the host country can also help firms develop capabilities to manage local inter-organizational collaborations more efficiently. For instance, manufacturing or sales subsidiaries often engage in franchising, licensing, or supplier agreements, which provide learning about managing contractual and relational risks (Alon et al., 2021). These learnings can later be applied to R&D partnerships to balance openness and protection in innovation projects (Bogers, 2011). Through such cross-functional learning, MNCs can strengthen their ability to explore new technologies in weak IPR regimes, where relational trust and contract design become critical substitutes for legal protection.

At the same time, international function-generic experience can enhance HBA in strong IPR regimes. Firms with manufacturing or operational experience often rely heavily on trade secrets, leading them to develop deep knowledge of secrecy management and legal boundaries (Crittenden et al., 2015). This experience helps R&D departments navigate trade secret and non-disclosure issues when hiring employees from competitors (Contigiani et al., 2018). Over time, MNCs may learn to identify which types of trade secrets are difficult to prove in court when infringed upon, providing strategic flexibility even when source firms pursue litigation. Additionally, firms with supplier or production networks in the host country learn how rigorously local firms enforce contractual clauses. This insight allows R&D units to target recruitment from firms or regions with lower IP enforcement intensity ("low IP toughness"; Agarwal et al., 2009), thereby facilitating access to skilled personnel while minimizing legal exposure. Therefore, we hypothesize:

H2c. *MNCs' function-generic (non-innovation) and host-country-specific experience moderates the relationship between the host-country IPR regime and MNCs' TS and HBA activities, such that the more experienced the MNC, the less the strength of the host country's IPR regime affects the MNC's engagement in TS and HBA.*

Function-generic and country-generic experience of MNCs

Finally, function-generic and country-generic experience, gained from managing non-innovation activities across multiple international markets, further enhances MNCs' ability to navigate IPR environments through institutional knowledge transfer and cross-functional integration. Institutional and operational practices developed in one market, such as handling IP-related disputes, contract negotiations, or compliance monitoring, can be transferred horizontally between functionally similar subsidiaries (e.g., manufacturing-to-manufacturing, marketing-to-marketing) (Kaiser and Friedli, 2025; Schlegelmilch and Chini, 2003; Szász et al., 2019) especially when they are interdependent (Foss and Pedersen, 2002) and then vertically to inform R&D activities. For instance, a sales subsidiary with experience enforcing licensing agreements in another foreign country can share its routines with a host-country sales subsidiary, which in turn collaborates with the R&D subsidiary to design IP-sensitive partnerships. This cascading flow of institutional knowledge supports both TS and HBA by improving MNCs' ability to operate effectively in the host country.

Moreover, MNCs often establish cross-functional teams that span multiple countries, facilitating the transfer of non-R&D knowledge to R&D units, as Seo et al. (2020, p.858) notes "researchers with less invention experience tend to be better at embracing fresh ideas and bringing them to a project because they are less socialized to established and predominant norms and values in innovation activities". Berry (2014) finds evidence of multi-country collaborative projects where manufacturing and R&D integration enhanced innovation outcomes by improving coordination and knowledge sharing across functions. Similarly, Nielsen and Michailova (2007) describe a Danish MNC's global knowledge management system that allows codified knowledge from

diverse projects to be accessed by 80,000 employees across 60 countries. Such collaborations allow direct transfer of knowledge regarding the institutional enforcement and organizational routines from non-innovation functions to the host country innovation R&D subsidiaries, which can be leveraged to strengthen both TS and HBA activities.

Finally, function-generic international experience enhances cultural intelligence — the ability to understand and navigate cultural and institutional differences across markets (Le and Kroll, 2017; Perkins, 2014). The cultural dimensions of IPR, including attitudes toward ownership, innovation, and knowledge sharing, vary widely across countries (Geuna and Rossi, 2011; Yang, 2005). By experiencing these differences, MNCs become adept at interpreting local expectations, which is critical for successfully hiring R&D talent or engaging in technology collaborations under diverse institutional constraints (Borah et al., 2023b). This broader institutional and cultural understanding makes MNCs less affected by the strength of formal IPR systems, enabling them to adapt both their TS and HBA activities to the realities of each host environment. Thus, we hypothesize:

H2d. *MNCs' function-generic (non-innovation) and country-generic experience moderates the relationship between the host-country IPR regime and MNCs' TS and HBA activities, such that the more experienced the MNC, the less the strength of the host country's IPR regime affects the MNC's engagement in TS and HBA.*

3. Sampling

This study focuses on US public firms in the computer and electronics products manufacturing sector (NAICS³ 334) from 1994 to 2019. In OECD countries, the computer and electronics industry is a top R&D spender with the highest R&D intensity and growth rate (Galindo-Rueda and Verger, 2016; OECD, 2022). In 2019, 12 of the top 20 companies ranked by USPTO patents were in this industry (IPO, 2020). The computer and electronic products subsector (NAICS 334), a knowledge-intensive sector with high R&D spending, accounts for a significant share of manufacturing R&D (Moris, 2021). Given its substantial R&D investments and patent filings, the strength of the IPR regime is expected to play an important role in this sector.

We began by listing all companies in the Compustat database as of 2019 and narrowed our focus to those within the specified NAICS codes: Computer and Peripheral Equipment Manufacturing (3341), Communications Equipment Manufacturing (3342), Audio and Video Equipment Manufacturing (3343), and Semiconductor and Other Electronic Component Manufacturing (3344). This initial filter returned 218 firms from which we extracted financial statement information via Compustat.

Patents are widely recognized as a measure of innovation output and have been extensively used in research for decades (Griliches et al., 1987; Nagaoka et al., 2010; Xu et al., 2024) despite their limitations (Archibugi, 1992; Pavitt, 1988). We use PATSTAT, which contains bibliographic data on over 100 million patents from 90 authorities (PATSTAT, 2017). Using the company name (including subsidiary name (s) according to each company's official website) as the keyword to search in the PATSTAT database (2023 autumn edition), we identify the patent filing information of selected firms. Some firms did not provide patent information in the database and were eliminated from the sample. Since the reviewing process of a patent application takes an average of two years from the filing date, to reduce truncation bias, it is customary to exclude patents filed at least three years prior to the end date of the patent database (Dass et al., 2017; Hall et al., 2001). Therefore, we have included patents filed until the end of 2019, which also effectively eliminated the potential impacts of COVID-19 on patent

offices' work around the globe.

Patents disclose inventors' locations, allowing the identification of countries where firms organize innovation activities, identified by patents filed with inventors residing in the country in any three years during the sample period (Nandkumar and Srikanth, 2016). Using this patent information, we compiled a list of host countries in which each company conducts its innovation activities. Companies without patents filed by overseas inventors, or those that filed patents with overseas inventors for fewer than three years during the sample period, were excluded from the sample. We also reviewed annual reports from SEC filings to verify the presence and location of overseas subsidiaries, as well as the number of subsidiaries in each country during the sample period. Firms without overseas subsidiaries were excluded. The final dataset comprises 108 companies with innovation activities across 105 countries.

Fig. 1 shows the trends in both the total number of overseas subsidiaries and the proportion of innovation output conducted overseas by the sample firms from 1994 to 2019. The number of overseas subsidiaries exhibits a steady increase starting in 1999, peaking around 2016, followed by a slight decline and stabilization. In contrast, the proportion of overseas innovation (the number of patent applications with overseas inventors divided by the total number of patent applications by the companies in the sample) remained low until 2000, after which it saw significant growth, peaking in 2010 before decreasing and stabilizing at approximately 40% after 2013. This suggests that, while the expansion of subsidiaries continued to grow steadily, the proportion of innovation conducted overseas followed a more volatile path, highlighting differing trends in geographical expansion and innovation.

4. Empirical analysis

In this section, we test whether the strength of IPR regimes in host countries affects the extent to which MNCs implement the two different types of technology exploration activities, TS and HBA, as well as the moderating roles of MNCs' function-related and location-related experience in this relationship.

4.1. Variables

4.1.1. Dependent variables

As we investigate the impact of the strength of IPR systems on MNCs' technology exploration activities, focusing on TS and HBA, we calculate the dependent variables as the proportion of the MNC's R&D activities attributed to each of TS and HBA across different host countries and over time.

Building on Patel and Vega (1999) and Le Bas and Sierra (2002), we develop an alternative measure of technology exploration activities with all elements focused on the focal company's relative advantage. Specifically, Patel and Vega (1999) and Le Bas and Sierra (2002) compare a firm's RTA index at home (CompHomeRTA) with the RTA of the host country (HostRTA) in a given technology; instead, we calculate the RTA index based on the company's patenting at home (CompHomeRTA) and the company's patenting activities in the host countries where it has innovation activities (CompHostRTA). This allows us to assess the individual firm's advantage of R&D activities at home and in the host country relative to other companies in the industry in those countries, to maintain a focus on the relative strength of a firm's innovative activities, and to assess them through a direct comparison of the firm's strength at home and overseas. In general, as shown in RTA formula (1) below, P_{ij} indicates the number of patents granted to the focal firm in technological field j by inventors located in country i . In the numerator, P_{ij} is divided by the sum of the focal firm's patents in field j across all the countries ($\sum_i P_{ij}$). The denominator is the share of the focal firm's patents in all technological fields by inventors located in country i ($\sum_j P_{ij}$) divided by the total number of patents of the firm across all fields globally ($\sum_{ij} P_{ij}$). An RTA value above 1 indicates a firm's relative

³ NAICS Association. (2024) NAICS & SIC Identification Tools. Available at: <https://www.naics.com/> (Accessed: 21 June 2024).

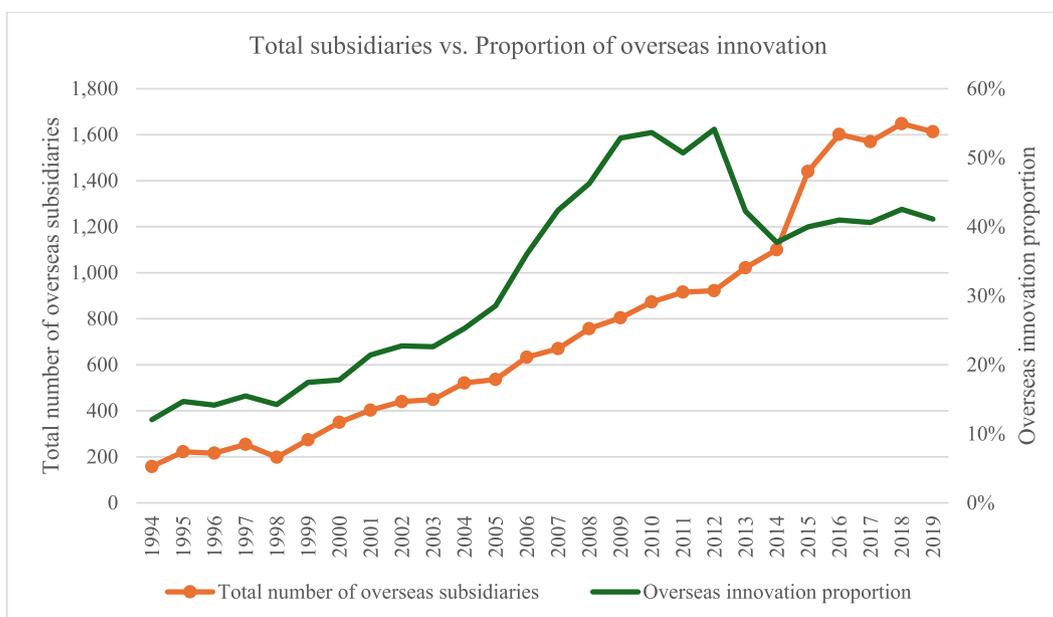


Fig. 1. Trends in overseas expansion and innovation output of sample firms (1994–2019): Total Subsidiaries vs. Proportion of Overseas Innovation.

specialization in that technology field in country i , while a value less than 1 indicates a relative weakness in that technology field in that country (Patel and Vega, 1999).

$$RTA_{ij} = \frac{(P_{ij} / \sum_i P_{ij})}{\sum_j P_{ij} / \sum_{ij} P_{ij}} \quad (1)$$

Similar to Patel and Vega (1999), we calculate the focal firm's HomeRTA $_i$ (CompHomeRTA) and the firm's HostRTA $_{ij}$ (CompHostRTA) separately and then identify TS and HBA by comparing the RTA value of a firm at home and the RTA in host countries. Briefly, in HBA, the firm has technological advantages in both the home and host countries (CompHomeRTA >1 and CompHostRTA >1), whereas in TS, the firm has technological advantages in the host country but not in the home country in a specific field (CompHostRTA >1 and CompHomeRTA <1).

For the analysis in this study, we used the number of patents (by counting the distinct DOCDB family ID⁴) of inventors from a firm's host/home country in each technology field divided by the total number of patents of the firm in each technology field across all countries for the numerator, and use the sum of the number of patents (by counting the distinct DOCDB family ID) of inventors from the firm's host/home country in all technology fields divided by the total number of patents of the firm in all technology fields globally for the denominator (as shown in formula 1).

Among the 105 countries in which our sample firms have innovation activities, we only list the top 30 countries and regions where the sample companies filed the most patents, noting that countries with a higher number of patents filed by companies with inventors located in that country tend to have a lower proportion of patents focused on TS and HBA (see Appendix 1).

4.1.2. Explanatory variable and moderators

We use the patent enforcement index (PEI) 1998–2017 which was developed by Papageorgiadis and Sofka (2020), as a measure of the IPR protection strength of host countries. PEI evaluates the strength and effectiveness of patent enforcement in various countries by considering

⁴ DOCDB is “the EPO's master documentation database with worldwide coverage”, a single-family ID “is a collection of patent documents that are considered to cover a single invention” (EPO, 2017).

service costs, costs associated with protecting property rights and monitoring expenses. It examines the efficiency of patent administration, judicial processes and monitoring systems, offering a practical perspective on enforcing patent rights (Papageorgiadis and Sofka, 2020). PEI ranges from 0 to 10, where “0” indicates no protection and “10” signifies full protection.

We propose that a firm's function-specific (innovation-related) and function-generic (non-innovation) experience in both the host country and other foreign countries moderate the relationship between host-country IPR regime and the firm's TS and HBA activities (H2a–H2d). Specifically, for H2a, which concerns function-specific and host-country-specific experience, we use two indicators: the number of years the firm has actively engaged in patenting activities in the host country and the cumulative number of innovation collaborations established in the host country. For H2b, which captures function-specific and country-generic experience, we measure the number of years the firm has engaged in patenting activities overseas and the cumulative number of innovation collaborations established in other foreign countries. For H2c, representing function-generic and host-country-specific experience, we use the total number of subsidiaries the firm has in the host country, while for H2d, reflecting function-generic and country-generic experience, we use the total number of subsidiaries the firm has in other foreign countries. The “Innovation collaborations experience in other foreign countries” and the number of overseas subsidiaries variables were log-transformed to contain the potential impact of outliers. Additionally, to better understand the temporal impact of these experiences on a firm's technology exploration activities and to address any concerns regarding reverse causality, the independent variables and moderators (except for international patenting experience, which already takes into account cumulative past innovation activities) are lagged by one year (Sampson, 2005).

4.1.3. Control variables

Only a small number of companies publish the financial information of their subsidiaries; therefore, we refer to the parent company's data for the control variables. Scholars have long highlighted the strategic importance of innovation in R&D intensity to a firm (e.g., Cohen and Levinthal, 1989; Colombo et al., 2021) and that it affects a firm's R&D strategies; therefore, we control for R&D intensity by dividing R&D expenditure by sales revenue in the same year (Teixeira and Tavares-Lehmann, 2014). We use Return on Assets (ROA) to control for the

potential influence of a firm's performance on innovation activities (Lee et al., 2014). We control for company size, as larger firms are more likely to carry out advanced innovation activities overseas (Bardhan and Jaf-fee, 2005). Since the focal firm's innovation capacity in the host country can influence its choice of different R&D strategies (Geiger and Makri, 2006), we control for this effect by computing the cumulative number of patents applied for by inventors located in a host country to measure the company's innovation capacity in that country.

At the host-country level, we first control for urbanization which is measured by the proportion of the population living in urban areas, because higher levels of urbanization are frequently linked to greater innovation potential (Lyu et al., 2009). We also control for ICT export, which reflects a country's technological infrastructure and capacity to support advanced R&D activities, as well as the openness of international trade (Lee et al., 2014). This factor can significantly influence a firm's innovation strategies and ability to engage in R&D abroad (Keller, 2004). Accessing specialized knowledge or technology resources is one of the key driving forces for MNCs to locate R&D abroad (Manning et al., 2008), therefore a country's R&D intensity (the ratio of R&D expenditures/GDP) is used as an indicator of the country's innovation capability (e.g., Godin, 2005). Additionally, we include the cumulative number of patent applications submitted by residents in previous years to control for the country's overall innovation capacity (Hu and Mathews, 2005). A host country with greater innovation capacity and a more developed innovation landscape is more likely to affect MNCs' innovation strategies and outputs (Liu and Li, 2022).

Given that there is normally a time lag between R&D investments and the resulting output (patent applications) (Kondo, 1999), and that host-country factors influencing technology exploration also require time to take effect, we applied a one-year lag to all control variables. Additionally, we applied a logarithmic transformation to variables that exhibited high skewness: the MNC's cumulative innovation in host countries, total assets and the host country's cumulative innovation. This transformation normalizes the distribution of these variables and improves the model fit.

Table 2 presents a summary of the definition and operationalization of the variables used in the regression models.

4.2. Regression results

The original dataset for this study encompasses 105 host countries from 1994 to 2019. However, due to the availability constraints of some independent variables, such as the PEI, which only covers 51 countries between 1998 and 2017, our final analysis is limited to a subset of the original data, and the final dataset includes 91 companies with active innovation activities in 48 countries from 2001 to 2018. Due to the longitudinal nature of the dataset, we address potential biases stemming from unobserved characteristics of individual firms by adopting a fixed-effects regression model (Allison, 2009). Table 3 reports the descriptive statistics, and the correlation matrix of the explanatory variables included in the analysis. Variance inflation factor (VIF) tests were also performed to further check for collinearity between variables. We found that the VIF scores of the independent variables ranged between 1.11 and 2.72, which indicates the absence of collinearity (lower than 10) (Wooldridge, 2012).

Model 0 in Table 4 presents the baseline model testing the effects of control variables on the MNCs' TS and HBA activities that they adopt in different host countries. The regression results indicate that the number of collaborations, the number of subsidiaries MNCs have in host countries, overseas patenting experience, number of overseas innovation collaborations, firm size, R&D intensity, firm performance and host-country innovation capacity are positively related to MNCs' TS activities in its total R&D activities in the host country. Conversely, MNCs' patenting experience in host countries and cumulative innovation in the host country are negatively related to TS activities. Regarding the adoption of the HBA activities, the regression results show that firms'

Table 2
Variables definition and operationalization.

	Variable name	Variable description	Data source
Dependent variable	Home-base augmenting	The share of an MNC's "home-base augmenting" activities: The number of cases of an MNC's "home-base-augmenting" activities divided by the total number of all location activities of the MNC.	PATSTAT
	Technology-seeking	The share of an MNC's "technology-seeking" activities: The number of cases of an MNC's "technology-seeking" activities divided by the total number of cases of all location activities of the MNC.	PATSTAT
Explanatory variables	Host-country IPR	Patent enforcement index measures the strength and effectiveness of patent enforcement across countries, focusing on servicing costs, property rights protection costs, and monitoring costs. It evaluates the efficiency of patent administration, judicial enforcement, and monitoring mechanisms, providing insights into the practical enforceability of patent rights (one year lagged).	(Papageorgiadis and Sofka, 2020)
Moderators	Function (Innovation)-specific and (host) country-specific experience of MNCs	a) Patenting experience in host country: The number of years that the firm has patenting activities in the focal host country. b) Innovation collaborations in host country: The cumulative number of collaborations that the focal company has in the focal host country: If a patent is filed jointly by the focal company and another local company or organization, it is considered one collaboration. This variable represents the cumulative number of such collaborations the company has in that host country (one year lagged).	PATSTAT
	Function-specific and country-generic experience of MNCs	a) Patenting experience overseas: The number of years that the firm has engaged in overseas patenting activities. If the earliest year of overseas patenting coincides with the year patenting began in the focal host country, then the start year for overseas patenting in	PATSTAT

(continued on next page)

Table 2 (continued)

Variable name	Variable description	Data source
	the focal country should be the earliest year when patenting began in other overseas countries, excluding the focal country.	
	b) Innovation collaborations overseas: The cumulative number of collaborations that the focal company has overseas, excluding those in the focal host country, is calculated as follows: The cumulative number of overseas collaborations minus the cumulative number of collaborations in the focal host country. If a patent is filed jointly by the focal company and another overseas company or organization, it is considered one collaboration. This variable represents the cumulative number of such collaborations the company has overseas (logged and one year lagged).	
Function-generic and country-specific experience of MNCs	The number of subsidiaries of the focal firm in the host country (one year lagged).	Subsidiary Data is derived from SEC filings, with a focus on Exhibit 21.
Function-generic and country-generic experience of MNCs	The number of overseas subsidiaries the focal firm has, excluding those in the focal host country (logged and one year lagged).	Subsidiary Data is derived from SEC filings, with a focus on Exhibit 21.
Control variables		
Firm R&D intensity	The focal firm's R&D intensity is expressed as R&D spending divided by the focal company's sales revenue in the focal host country (one year lagged).	Compustat
Firm size	Annual total assets of the focal company (logged and one year lagged).	Compustat
Firm return on assets	The annual return on assets of the focal company in the given year (one year lagged).	Compustat
Cumulative innovation in host country	The cumulative number of patents applied by the focal company in the focal host country (logged and one year lagged)	PATSTAT
Urbanization	Urban population (% of total population): Urban population refers to people living in urban areas as defined by national statistical offices. The data are collected and smoothed by United Nations Population Division (one year lagged).	World bank Open Data platform

Table 2 (continued)

Variable name	Variable description	Data source
ICT export	The sum of ICT goods and service exports - ICT goods exports (% of total goods exports): Information and communication technology goods exports include computers and peripheral equipment, communication equipment, consumer electronic equipment, electronic components, and other information and technology goods (miscellaneous); ICT service exports (% of service exports): Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions). (one year lagged)	World bank Open Data platform
Host-country R&D intensity	The percentage of gross domestic expenditure for R&D activities (expressed as a percent of GDP) in host countries (one year lagged).	World bank Open Data platform
Host-country innovation capacity	The number of patents applied by residents (logged and one year lagged).	World bank Open Data platform

R&D intensity and firm size are positively related to MNCs' HBA activities in the host country, while MNCs' cumulative innovation in the host country is negatively related. In Model 1, the regression results show that the relationship between the IPR protection strength in host countries and adoption of TS activities is not significant (0.002, $p = 0.849$). However, IPR in host country is negatively associated with the adoption of the HBA activities, albeit with a low level of significance (-0.017 , $p = 0.071$). The results indicate that a one standard deviation increase in the strength of IPR protection in a host country corresponds to approximately a 1.7% decrease in the share of MNCs' HBA activities in that host country.

Models 1 to 6 in Table 5 present the results of the regression models testing all hypotheses. The findings indicate that the strength of IPR protection in host countries exhibits a positive non-significant relationship with the adoption of the TS activities in MNCs. In contrast, weaker IPR protection is generally associated with a higher likelihood of MNCs adopting HBA in the host country. However, the statistical significance of this inverse relationship varies, with stronger significance in Models 1 ($p = 0.012$), 4 ($p = 0.001$) and 5 ($p = 0.017$). The results show that a one standard deviation increase in the strength of IPR protection in a host country leads to an approximate 2–4% decrease in the adoption of HBA activities. These findings suggest that MNCs may favour HBA activities in countries with weaker IPR regimes. Consequently, based on the regression results, Hypothesis 1a is not supported, whereas

Table 3
Descriptive statistics and correlations for explanatory and control variables: the share of four R&D strategies that firms adopted in host countries in computer and electronics industry.

Variable	Obs.	Mean	Std. Dev.	Min	Max	1a	1b	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1a TS	11,312	0.236	0.342	0	1	1.000																	
1b HBA	11,312	0.194	0.319	0	1	-0.103*	1.000																
2 Host-country IPR ^c	11,312	6.471	2.181	0.2	9.7	0.033*	-0.046*	1.000															
3 Patenting experience in host country	11,312	12.765	9.092	1	64	0.043*	0.008	0.182*	1.000														
4 Inno. collaborations in host country ^c	11,312	1.589	8.903	0	165	0.043*	0.020	0.080*	0.244*	1.000													
5 Number of subsidiaries in host country ^c	11,312	1.244	2.691	0	55	0.068*	0.035*	0.077*	0.143*	0.058*	1.000												
6 Overseas patenting experience	11,312	26.350	13.231	-6	74	-0.007	0.046*	-0.072*	0.497*	0.097*	0.074*	1.000											
7 Overseas inno. Collaborations ^{a,c}	11,312	2.600	1.840	0	5.838	0.045*	0.117*	-0.129*	0.406*	0.126*	-0.031*	0.640*	1.000										
8 Number of overseas subsidiaries ^{b,c}	11,312	2.998	1.124	0	5.974	-0.027*	0.070*	-0.007	0.165*	0.047*	0.389*	0.288*	0.249*	1.000									
9 Firm R&D intensity ^c	11,312	0.154	0.126	0.001	2.010	0.012	-0.007	0.010	-0.157*	-0.027*	-0.134*	-0.301*	-0.208*	-0.235*	1.000								
10 Firm size ^{b,c}	11,312	8.700	1.926	2.362	12.836	0.102*	0.167*	-0.107*	0.263*	0.069*	0.081*	0.495*	0.682*	0.379*	-0.286*	1.000							
11 Firm return on assets ^c	11,312	0.052	0.167	-10.537	1.456	0.050*	0.027*	-0.037*	0.076*	-0.007	-0.031*	0.133*	0.119*	0.035*	-0.197*	0.245*	1.000						
12 Cumulative innovation in host country ^{b,c}	11,312	2.443	1.615	0	8.563	0.189*	0.106*	0.043*	0.600*	0.283*	0.140*	0.303*	0.398*	0.083*	-0.050*	0.383*	0.073*	1.000					
13 Urbanization ^c	11,312	75.365	17.188	27.667	100	0.010	-0.057*	0.566*	0.121*	0.089*	-0.016	0.038*	0.019	0.019	-0.014	0.016	0.012	-0.023	1.000				
14 ICT export ^c	11,312	20.787	14.097	2.142	58.897	-0.001	0.042*	-0.039*	-0.037*	-0.026*	0.109*	-0.082*	-0.062*	-0.044*	0.037*	-0.085*	-0.032*	0.086*	-0.270*	1.000			
15 Host-country R&D intensity ^c	11,312	1.881	0.992	0.083	4.624	0.062*	-0.031*	0.568*	0.173*	0.158*	0.061*	-0.073*	-0.126*	-0.028*	0.021	-0.100*	-0.027*	0.136*	0.474*	0.021	1.000		
16 Host-country innovation capacity ^{b,c}	11,312	8.659	2.116	3.091	14.035	0.066*	0.020	-0.058*	0.121*	0.174*	0.167*	0.154*	-0.233*	-0.099*	0.040*	-0.225*	-0.066*	0.205*	-0.167*	-0.050*	0.367*	1.000	

^a Notes: Logarithm transformed (overseas collaborations +1)

^b Logarithm transformed

^c one year lagged.

* $P < 0.01$.

Table 4
The effect of IPR on TS and HBA activities (Fixed effects regression).

	Model 0		Model 1	
	TS	HBA	TS	HBA
Host-country IPR ^c			0.002 [0.849]	-0.017 [0.071]
Patenting experience in host country	-0.219 [0.005]	0.002 [0.978]	-0.220 [0.005]	0.003 [0.965]
Innovation collaborations in host country ^c	0.001 [0.076]	-0.001 [0.416]	0.001 [0.077]	-0.0005 [0.441]
Number of subsidiaries in host country ^c	0.011 [0.000]	0.003 [0.245]	0.011 [0.000]	0.003 [0.238]
Overseas patenting experience	0.214 [0.007]	-0.003 [0.968]	0.214 [0.006]	-0.004 [0.958]
Overseas innovation collaborations ^{a,c}	0.023 [0.007]	0.008 [0.306]	0.023 [0.007]	0.009 [0.289]
Number of overseas subsidiaries ^{b,c}	-0.002 [0.791]	0.006 [0.350]	-0.002 [0.794]	0.006 [0.369]
Firm R&D intensity ^c	0.033 [0.398]	0.139 [0.000]	0.033 [0.399]	0.140 [0.000]
Firm size ^{b,c}	0.044 [0.000]	0.033 [0.007]	0.044 [0.000]	0.034 [0.000]
Firm return on assets ^c	0.063 [0.003]	0.007 [0.720]	0.063 [0.003]	0.005 [0.802]
Cumulative innovation in host country ^{b,c}	-0.041 [0.000]	-0.051 [0.000]	-0.041 [0.000]	-0.052 [0.000]
Urbanization ^c	0.001 [0.573]	-0.001 [0.792]	0.001 [0.575]	-0.001 [0.806]
ICT export ^c	0.001 [0.269]	-0.001 [0.480]	0.001 [0.275]	-0.0004 [0.551]
Host-country R&D intensity ^c	-0.007 [0.650]	-0.017 [0.232]	-0.007 [0.647]	-0.017 [0.250]
Host-country innovation capacity ^{b,c}	0.036 [0.001]	0.002 [0.856]	0.036 [0.002]	0.003 [0.797]
_cons	-3.391 [0.002]	0.085 [0.934]	-3.403 [0.002]	0.191 [0.852]
Year fixed	Yes	Yes	Yes	Yes
Firm fixed	Yes	Yes	Yes	Yes
N (obs)	11,312	11,312	11,312	11,312
N (groups)	1023	1023	1023	1023
F stat	11.63 [0.000]	12.64 [0.000]	10.86 [0.000]	12.01 [0.000]

^a Notes: Logarithm transformed (overseas collaborations + 1)
^b Logarithm transformed
^c one year lagged; p-values in brackets.

Hypothesis 1b is supported.

The regression results show that the moderating effects of firms' innovation experience and broader subsidiary experience, both in the host country and overseas, on the relationship between the strength of IPR in host countries and the adoption of TS activities are not significant. Despite the minimal impact of host-country IPR protection and its moderators, some control variables show stronger effects. Firm size, firm performance, and the innovation capacity of the host country are positively and significantly associated with MNCs' adoption of the TS activities, whereas there is a negative association with MNCs' cumulative innovation within the host country. This result suggests that an MNC's prior innovation experience and the presence of subsidiaries, whether in the host country or overseas, do not affect the impact of the strength of IPR protection in host countries on TS activities. That said, larger and more successful MNCs, as well as those operating in technologically advanced host countries, are more likely to pursue TS activities. However, MNCs that already have a strong track record of innovation activities in the host country are less likely to embark in these activities, possibly because they have already acquired sufficient local knowledge and resources, reducing the need to seek additional technological inputs.

On the other hand, the moderating effects of several variables shed new light on how the relationship between host-country IPR protection and the adoption of HBA activities within MNCs may be influenced by firm's function-specific experience in the host country and overseas. While overseas innovation collaborations (Model 5) show some limited

but positive moderating effect (0.004, $p = 0.085$), a firm's patenting experience in both the host country and overseas emerge as potentially important factors. In Models 1 and 4, the interaction term between host-country IPR protection and patenting experience in the host country and overseas is positive and significant (0.001, $p = 0.001$ and 0.001, $p = 0.003$ respectively), suggesting that MNCs with extensive innovation experience in a host country and overseas are better positioned to take advantage of strong IPR protection in host countries, potentially increasing their propensity to pursue HBA in these highly regulated environments. However, in Models 2, 3 and 6, the moderating roles of the number of subsidiaries in the host country and overseas, as well as the number of innovation collaborations in the host country, are not statistically significant. Therefore, with respect to H2a–H2d, the moderating effects are not supported for TS activities, as none of the interaction terms are significant. For HBA, only H2a and H2b yield significant effects, but in the opposite direction to that hypothesized: rather than weakening the influence of IPR regimes, greater patenting experience in host and foreign countries amplifies it, suggesting that more experienced MNCs are better able to leverage strong IPR protection when pursuing HBA. We provide a fuller discussion of these results in the Discussion and Conclusions section. Regarding the control variables, firm-specific factors such as R&D intensity and firm size are consistently and positively associated with the likelihood of pursuing HBA, highlighting the importance of internal resources and capabilities in augmenting home-based technological advantages. Conversely, cumulative innovation in a host country shows a negative relationship with HBA.

4.3. Robustness check

We conducted several robustness tests. We first test the robustness of the variables whose correlation coefficient are above 0.6 by running regressions where these variables are dropped separately, and the results do not show substantial differences. We also used variations of the measures of the overseas experience variables to include experience in the focal host country in the overall overseas experience, acknowledging that such experience contributes to a firm's broader learning and strategic development. The regression results remained consistent with our main tests, indicating robustness of our findings with respect to the experience construct. Results are available from the authors upon request.

In our main analysis, we identified host countries with innovation activities based on patent filings in any three years during the sample period. For the robustness check, we adopt a more stringent criterion and consider only host countries where a firm has filed at least five patents during the sample period (Almeida and Phene, 2004). This adjustment ensures that our results are not driven by sporadic patent filings but reflect a sustained innovation presence and that the firms' substantive innovation activities are robustly captured across different host countries. The regression results (Appendix 2) are mostly consistent with the main results presented in Table 5, except that the IPR protection strength in the host country in Model 2 is not significant for HBA. This could be attributed to the different number of observations, which were reduced by about 8%, but it also suggests that even limited innovation experience can affect the decision to implement HBA activities overseas.

To address potential endogeneity concerns and unobserved biases, we also employed an Instrumental Variable (IV) approach using Two-Stage Least Squares (2SLS) regression analysis. We used the Control of Corruption Index to account for potential biases in the relationship between host-country IPR protection strength and the dependent variables (TS and HBA). The results from the 2SLS analysis are largely consistent with our main findings, particularly for TS, which remain robust to endogeneity concerns. For HBA, the direct effects of IPR protection strength (H1b) become weaker in some models, while the interaction effect with experience (H2) holds, suggesting that the initial results may have been affected by some endogeneity or omitted variable bias,

Table 5
The effect of IPR and experience on TS and HBA (Fixed effects regression).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	TS	HBA										
Host-country IPR ^c	0.002 [0.810]	-0.025 [0.012]	0.002 [0.841]	-0.017 [0.080]	0.001 [0.916]	-0.018 [0.056]	0.002 [0.867]	-0.037 [0.001]	-0.0002 [0.983]	-0.025 [0.017]	0.009 [0.492]	-0.022 [0.066]
Host-country IPR* Patenting experience in host country	-0.0001 [0.818]	0.001 [0.001]										
Host-country IPR* Innovation collaborations in host country			-0.0001 [0.905]	-0.0002 [0.648]								
Host-country IPR* Number of subsidiaries in host country					0.001 [0.459]	0.001 [0.286]						
Host-country IPR* Overseas patenting experience							-7.23e-06 [0.983]	0.001 [0.003]				
Host-country IPR* Overseas innovation collaborations									0.001 [0.674]	0.004 [0.085]		
Host-country IPR* Number of overseas subsidiaries											-0.002 [0.396]	0.002 [0.481]
Patenting experience in host country	-0.219 [0.006]	-0.006 [0.940]	-0.219 [0.005]	0.004 [0.961]	-0.220 [0.005]	0.003 [0.968]	-0.220 [0.005]	0.004 [0.959]	-0.220 [0.005]	0.003 [0.969]	-0.220 [0.005]	0.003 [0.963]
Innovation collaborations in host country ^c	0.001 [0.076]	-0.001 [0.340]	0.002 [0.627]	0.001 [0.775]	0.001 [0.078]	-0.001 [0.435]	0.001 [0.077]	-0.001 [0.369]	0.001 [0.080]	-0.001 [0.402]	0.001 [0.075]	-0.001 [0.435]
Number of subsidiaries in host country ^c	0.011 [0.000]	0.002 [0.329]	0.011 [0.000]	0.003 [0.239]	0.004 [0.610]	-0.006 [0.473]	0.011 [0.000]	0.002 [0.318]	0.011 [0.000]	0.002 [0.265]	0.011 [0.000]	0.002 [0.259]
Overseas patenting experience	0.214 [0.007]	-0.003 [0.969]	0.214 [0.007]	-0.004 [0.954]	0.215 [0.006]	-0.004 [0.960]	0.215 [0.007]	-0.011 [0.877]	0.215 [0.006]	-0.004 [0.959]	0.215 [0.006]	-0.004 [0.955]
Overseas innovation collaborations ^{a,c}	0.023 [0.007]	0.009 [0.248]	0.023 [0.007]	0.009 [0.288]	0.023 [0.007]	0.009 [0.279]	0.023 [0.007]	0.009 [0.252]	0.017 [0.365]	-0.017 [0.312]	0.023 [0.007]	0.009 [0.291]
Number of overseas subsidiaries ^{b,c}	-0.002 [0.797]	0.006 [0.397]	-0.002 [0.794]	0.006 [0.367]	-0.002 [0.821]	0.006 [0.343]	-0.002 [0.795]	0.005 [0.436]	-0.002 [0.791]	0.006 [0.376]	0.013 [0.484]	-0.006 [0.736]
Firm R&D intensity ^c	0.033 [0.400]	0.140 [0.000]	0.033 [0.399]	0.139 [0.000]	0.033 [0.397]	0.140 [0.000]	0.033 [0.399]	0.140 [0.000]	0.033 [0.401]	0.139 [0.000]	0.033 [0.402]	0.140 [0.000]
Firm size ^{b,c}	0.044 [0.000]	0.033 [0.000]	0.044 [0.000]	0.034 [0.000]	0.044 [0.000]	0.033 [0.000]	0.044 [0.000]	0.034 [0.000]	0.044 [0.000]	0.034 [0.000]	0.044 [0.000]	0.034 [0.000]
Firm return on assets ^c	0.063 [0.003]	0.004 [0.830]	0.063 [0.003]	0.005 [0.804]	0.063 [0.003]	0.005 [0.802]	0.063 [0.003]	0.004 [0.854]	0.063 [0.003]	0.004 [0.831]	0.063 [0.003]	0.005 [0.805]
Cumulative innovation in host country ^{b,c}	-0.041 [0.000]	-0.050 [0.000]	-0.041 [0.000]	-0.052 [0.000]	-0.041 [0.000]	-0.052 [0.000]	-0.041 [0.000]	-0.050 [0.000]	-0.041 [0.000]	-0.051 [0.000]	-0.041 [0.000]	-0.052 [0.000]
Urbanization ^c	0.001 [0.576]	-0.0005 [0.826]	0.001 [0.570]	-0.0005 [0.828]	0.001 [0.540]	-0.0004 [0.866]	0.001 [0.576]	-0.0002 [0.936]	0.001 [0.554]	-0.0002 [0.911]	0.001 [0.597]	-0.0005 [0.827]
ICT export ^c	0.001 [0.288]	-0.0002 [0.789]	0.001 [0.277]	-0.0004 [0.540]	0.001 [0.260]	-0.0004 [0.587]	0.001 [0.277]	-0.0002 [0.743]	0.001 [0.262]	-0.0003 [0.647]	0.001 [0.282]	-0.0004 [0.561]
Host-country R&D intensity ^c	-0.007 [0.646]	-0.016 [0.259]	-0.007 [0.639]	-0.017 [0.230]	-0.007 [0.630]	-0.017 [0.236]	-0.007 [0.647]	-0.016 [0.276]	-0.007 [0.654]	-0.016 [0.265]	-0.007 [0.639]	-0.016 [0.253]
Host-country innovation capacity ^{b,c} _cons	0.035 [0.004] -3.396 [0.002]	0.016 [0.158] 0.109 [0.915]	0.036 [0.002] -3.401 [0.002]	0.002 [0.842] 0.195 [0.848]	0.038 [0.001] -3.418 [0.002]	0.005 [0.675] 0.170 [0.868]	0.036 [0.003] -3.403 [0.002]	0.013 [0.238] 0.228 [0.823]	0.037 [0.001] -3.402 [0.002]	0.006 [0.565] 0.194 [0.850]	0.036 [0.002] -3.444 [0.002]	0.003 [0.783] 0.223 [0.828]
Year fixed	Yes	Yes										
Firm fixed	Yes	Yes										
N (obs)	11,312	11,312	11,312	11,312	11,312	11,312	11,312	11,312	11,312	11,312	11,312	11,312
N (groups)	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023
F stat	10.18 [0.000]	11.91 [0.000]	10.18 [0.000]	11.28 [0.000]	10.21 [0.000]	11.33 [0.000]	10.18 [0.000]	11.83 [0.000]	10.29 [0.000]	11.45 [0.000]	10.23 [0.000]	11.29 [0.000]

^a Notes: Logarithm transformed (overseas collaborations +1)

^b Logarithm transformed

^c one year lagged; p-values in brackets.

although not substantially. Detailed methodologies, regression tables, and additional analyses are provided in the Supplementary Material.

5. Discussion and conclusions

We examined the impact of host-country IPR regimes on two types of technology exploration activities by MNCs, TS and HBA, and found that the normally accepted positive role of strong IPR regimes obscures important differences in how these activities respond to IPR strength.

Supporting [H1b](#), our results show a significant negative association between IPR strength and HBA, indicating that MNCs tend to undertake a higher proportion of HBA under weak IPR regimes. HBA involves extending and refining existing technological capabilities, where the speed of knowledge recombination and integration is more critical than strong IPR regimes protecting proprietary knowledge leakages. Weak IPR regimes facilitate such processes by enabling more flexible access to external technologies, easing knowledge exchange, and allowing firms to hire local R&D personnel more freely, thus accelerating localized

learning. This unconstrained flow of knowledge and talent fosters open experimentation and rapid innovation (Belderbos et al., 2021), which might otherwise be hindered by lengthy licensing negotiations and contractual stringency in strong IPR environments (Borah et al., 2023b). In this sense, while weak IPR regimes may heighten imitation risks, they also increase the clockspeed of technological innovation, which can outweigh such risks in industries like computer and electronics manufacturing, where innovation speed and time-to-market are critical sources of competitive advantage (Carrillo, 2005). Nonetheless, this pattern may differ in low-clockspeed industries such as aircraft and petrochemicals (Nadkarni and Narayanan, 2007), warranting further investigation.

We are not the first to suggest that weak IPR regimes can foster innovation. Prior research has primarily focused on indigenous firms in developing countries, arguing that limited IPR enforcement enables imitation-based learning and accelerates technological catch-up by removing legal and contractual barriers to knowledge access (Belderbos et al., 2021; Kale and Little, 2007). Our findings extend this reasoning to MNCs, showing that weak IPR regimes can also provide strategic benefits to foreign firms. Although MNCs are often viewed as the victims of weak enforcement, they can benefit too from the same openness that local firms exploit. The underlying mechanism, however, is rather different. While local firms rely on imitation to access technologies where they have limited prior expertise, MNCs engaged in HBA activities benefit from weak IPR environments to accelerate the recombination and refinement of knowledge in areas where they already possess strong capabilities. In this context, the velocity of knowledge integration and adaptation becomes more important than legal protection, allowing MNCs to innovate faster despite higher imitation risks, especially in a high clockspeed setting.

However, our results showed no support for our hypothesis of a significant positive association between a host country's IPR strength and TS (H1a). One possible explanation could be that some MNCs in our sample conduct TS for the same technology across multiple host countries simultaneously. Hence, these MNCs may not experience a high technological distance when sourcing technology from the focal host country, as the subsidiary may have already received knowledge about the functioning and application of the technology from other overseas subsidiaries. This may eliminate the need for a lengthy trial-and-error process (Yang and Steensma, 2014) involving newly hired R&D employees (if the technology is sourced via hiring) and/or innovation collaborators (if the technology is sourced through innovation collaborations in the host country) to identify suitable technology combinations and applications. Therefore, the MNC may not have significant concerns about leakage of critical knowledge in fields where the MNC is an expert but the host country is not. Hence, a strong IPR regime may not be necessary for MNCs to engage in TS. Another explanation, and possible avenue for future research, is that MNCs may use alternative strategies for patents to protect core technologies during TS activities in a host country, such as secrecy, strategic time to market, design complexity, and modularity. Not all alternative strategies require a strong IPR regime (e.g., see Keupp et al., 2009).

Consistent with H2a and H2b, our results show that function-specific (innovation) experience, whether acquired within the host country (country-specific) or across other foreign markets (country-generic), significantly moderates the relationship between host-country IPR strength and MNCs' engagement in HBA. This experience enables firms to pursue HBA activities effectively, irrespective of the host country's IPR strength. Country-specific innovation experience equips MNCs with context-sensitive knowledge of local regulatory practices, enforcement procedures, and collaboration norms, allowing them to adapt IP strategies to the host environment. By contrast, country-generic innovation experience, accumulated through R&D activities across diverse markets, enables firms to generalize and effectively transfer routines, institutional templates, and governance mechanisms from one context to another. Together, these experiences strengthen firms' capability to manage the

trade-off between knowledge protection and sharing. Firms with extensive function-specific experience understand how to leverage prior learning about human capital mobility and knowledge recombination to extract and apply tacit knowledge even in highly protected IPR environments. For instance, they may selectively hire R&D employees from organizations less inclined to adopt an "IP toughness strategy" (Agarwal et al., 2009), thereby reducing exposure to legal disputes while accessing valuable expertise.

However, we find that function-generic experience, both in the host country (country-specific) and in other foreign countries (country-generic), does not moderate the impact of host-country IPR regimes on MNCs' technology exploration. While broader subsidiary experience fosters generic learning such as designing and enforcing copyrights and trademarks, this learning may be less critical for protecting new technologies, especially in industries such as computers and electronics. Additionally, although broader experience enhances the understanding of contracting practices (e.g., manufacturing, franchising, supplier agreements, and CSR), these contracts differ from R&D contracts used to protect explored technologies. Thus, generic learning from broader subsidiary learning may be less valuable than function-specific learning in technology exploration.

These findings align with prior literature suggesting that breadth of experience is valuable (Le and Kroll, 2017; Perkins, 2014; Putzhammer et al., 2018) but offer an important nuance: breadth of experience enhances technology exploration capability only when it is functionally relevant. Generic, non-innovation experience across countries does not provide the same advantage for technology exploration.

5.1. Implications for research and practice

This study contributes to the existing literature in several ways. First, we identify host-country IPR regimes as a critical institutional factor influencing the internationalization of R&D strategies and add to the debate. Our findings suggest that weak IPR regimes promote technology exploration, particularly HBA activities, by MNC subsidiaries. This challenges two prevailing perspectives in the literature. First, we question the conventional assumption that "the higher the level of IPR protection, the better [for innovation]" (Peng et al., 2017, p.903). Contrary to this view, we found a negative relationship between the IPR regimes and HBA. This also responds to Peng et al.'s (2017) call for more research exploring potentially more nuanced relationships between IPR regimes and innovation. Second, rather than viewing weak IPR purely as a liability for foreign investors, our findings suggest that it can act as an enabler of dynamic knowledge recombination and capability building for firms already possessing technological expertise.

While there is substantial literature on the impact of IPR systems on innovation, especially regarding R&D investments, entry modes, and IP protection strategies of MNCs, their effect on technology exploration still presents scope for more fine-grained analysis and improved understanding of underlying dynamics. Only a few studies (e.g., Athreye et al., 2016; Pisani and Ricart, 2018), as discussed in our literature review, have attempted to bridge this research gap; however, they do not provide a comprehensive picture or conclusive evidence. Our study offers more nuanced insights into how a host country's IPR regime affects the two types of technology exploration, TS and HBA, which previous studies have not fully addressed.

We elucidate the key conceptual distinctions between these two different technology exploration activities, TS and HBA, which are currently lacking in the literature. Studies have used the terms "knowledge-seeking" or "competence-seeking" to define technology exploration in host countries, which seem to combine HBA and TS, and sometimes these terminologies have been used interchangeably with HBA (e.g., see Pisani and Ricart, 2018). By drawing on the concept of technological distance and innovation speed, we provide more clarity regarding the conceptual differences between TS and HBA and report empirical evidence that shows that TS and HBA activities are affected

differently by the IPR system in the host country. We found that, while companies tend to adopt HBA in countries with weak IPR regimes, TS is not affected by IPR regimes. The results of TS suggest that when MNCs seek to elevate their technological expertise by locating R&D activities in a country with a higher relative level of technological competence, they are not concerned about the extent of the local IPR regimes, presumably because they expect to achieve their purpose by adapting to the local IP constraints. Moreover, a distinct moderating effect of international experience of MNCs was observed for the two activities.

Finally, our study makes an important contribution to the literature on experiential learning in innovation and international business. While prior research has examined international experience as a moderator of institutional effects and MNC strategies (Perkins, 2014; Thakur-Wernz and Samant, 2019), limited attention has been given to how different forms of experience shape firms' technology exploration activities. Our findings address this gap by demonstrating that function-specific experience plays a critical role in facilitating MNCs' innovation, regardless of whether such experience is country-specific (acquired in the focal host country) or country-generic (accumulated across other foreign markets). In other words, what matters is not only where the experience is gained, but also the type of activity through which it is developed. Function-specific learning deepens firms' understanding of the technological, organizational, and IPR-related dimensions of innovation, and this expertise can be effectively shared among subsidiaries in different markets. In contrast, function-generic experience, whether obtained in the host country or elsewhere, may enhance a firm's general familiarity with institutional environments, including IPR systems, in host countries, but it does not necessarily equip firms with the specific capabilities required to implement technology exploration activities within those systems.

Furthermore, these results may be particularly useful to managers who might consider expanding the range of overseas activities to include explorative innovation building on current non-innovation-related operations. Technology exploration activities require function-specific knowledge, and managers should be cautious when embarking on such initiatives because market knowledge or international supply chain experience alone may not be sufficient to support these strategically significant efforts. Firms aspiring to engage in technology exploration in foreign markets should first invest in building R&D and innovation capabilities in the host country, develop IP management expertise, and foster local innovation collaborative networks. This innovation-specific capability development can provide the necessary foundation for identifying promising technologies, implementing appropriate IP protection strategies, and effectively navigating the enforcement challenges inherent in diverse legal environments. Equally important is the sharing of institutional knowledge within the MNC network. Sharing this knowledge across the MNC's global R&D network can reduce redundancy in learning, minimize costly institutional missteps, and strengthen the innovation capabilities of other subsidiaries. Experienced R&D subsidiary can act as a knowledge sender, while a newer or less experienced subsidiary functions as a knowledge receiver that learns how to adapt these practices to its local setting.

Finally, from a policymaking perspective, while countries with weak IPR regimes face international pressure to adopt stricter regulations, weak IPR has both advantages and disadvantages. In the context of technology exploration, where the home country is already strong in a specific technological field, the decision to implement stringent IPR depends on the government's priority – whether to attract foreign MNC investments or enhance local firms' performance. If a country aims to attract FDI in that technological area, a weaker IPR regime may be advantageous. However, if the goal is to preserve the dominance of local

firms, a stronger IPR regime would be more beneficial.

5.2. Limitations and future research direction

This study has some limitations, which could be addressed in future research. First, our findings focus on MNCs in the computers and electronics industry, a knowledge-intensive sector with frequent patent filings, short product life cycles, and rapid technological upgrades. Future studies should examine other industries to assess whether our findings hold when innovation processes and strategies may respond differently to IPR regimes and time lags. Second, R&D internationalization strategies depend not only on parent company characteristics but also on local subsidiaries' capabilities and resources. While MNCs' international R&D strategies may be influenced by performance and investment levels in host countries, subsidiary-level data are not available and we rely solely on parent company data for control variables, leaving some influencing factors unaccounted for. Including subsidiary characteristics could enhance the empirical analysis. Third, past research suggests the emerging economy MNCs adopt different strategies than developed economy MNCs (Steinberg et al., 2018). Since we focused only on U.S.-based MNCs, future studies could include companies from emerging and developing economies to explore the role of IPR regimes in host countries and whether technology exploration varies with MNCs' home country's technological development. Additionally, future research could take a more critical view of how technology exploration, and more broadly the internationalization of R&D activities, are categorized. Rather than relying on the relatively crude definitions that have been adopted in the existing literature and in this paper, future studies could revisit these classifications and develop more nuanced conceptualizations that offer novel theoretical insights. Finally, while international function-specific experience offers opportunities for learning, whether firms actually learn depends on their learning capabilities and their decisions to either learn or “un-learn”, factors that we do not measure in this study. We encourage future research to collect primary data on these dimensions of organizational learning to provide more nuanced insights into how MNCs can leverage their experience with capabilities to engage in technology exploration across diverse IPR regimes.

CRedit authorship contribution statement

Jie Hong: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Dhruba Borah:** Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Silvia Massini:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT and Paperpal to improve language and readability. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Appendix 1

Characteristics of host countries — breakdown of R&D activities (TS + HBA + MS + HBE = 1).

Host country	Total number of patents	Market Seeking (MS)	Home-base Exploiting (HBE)	Technology-Seeking (TS)	Home-base Augmenting (HBA)	Technology exploration (TS ± HBA)	HBE ranking	Technology exploration ranking
India	17,554	0.19	0.21	0.30	0.30	0.60	2	30
China	13,458	0.17	0.19	0.32	0.33	0.65	4	28
United Kingdom	8801	0.12	0.17	0.45	0.26	0.71	6	24
Israel	8788	0.14	0.19	0.41	0.25	0.67	3	27
Germany	7919	0.12	0.15	0.46	0.26	0.72	7	23
South Korea	7907	0.14	0.23	0.41	0.22	0.63	1	29
Canada	6435	0.12	0.15	0.39	0.34	0.73	8	22
France	5171	0.13	0.17	0.39	0.30	0.70	5	25
Japan	4044	0.10	0.14	0.44	0.32	0.76	10	20
Taiwan	2988	0.11	0.11	0.38	0.40	0.78	15	16
Spain	2673	0.17	0.14	0.39	0.29	0.69	9	26
Italy	2160	0.12	0.10	0.47	0.30	0.78	18	17
Russia	1897	0.11	0.11	0.39	0.39	0.78	14	15
Singapore	1717	0.11	0.12	0.42	0.35	0.77	11	18
Ireland	1681	0.12	0.12	0.42	0.34	0.76	12	21
Malaysia	1621	0.13	0.09	0.40	0.38	0.78	21	14
Netherlands	1222	0.12	0.06	0.45	0.37	0.82	25	7
Australia	1173	0.10	0.08	0.46	0.35	0.82	23	8
Switzerland	1143	0.09	0.06	0.49	0.36	0.85	27	2
Belgium	1115	0.10	0.11	0.47	0.33	0.79	13	12
Finland	823	0.10	0.09	0.54	0.27	0.81	22	9
Denmark	772	0.07	0.09	0.55	0.28	0.84	19	4
Iran	588	0.13	0.06	0.42	0.38	0.80	26	11
Sweden	585	0.08	0.09	0.56	0.27	0.83	20	6
Austria	556	0.10	0.06	0.56	0.28	0.84	29	3
Turkey	545	0.14	0.05	0.44	0.37	0.81	30	10
Brazil	534	0.11	0.11	0.41	0.38	0.79	16	13
Mexico	529	0.07	0.06	0.49	0.38	0.87	28	1
Poland	513	0.13	0.11	0.44	0.33	0.77	17	19
Greece	404	0.10	0.07	0.47	0.35	0.83	24	5

Example: For India, TS (0.30) + HBA (0.30) + MS (0.19) + HBE (0.21) = 1.00. Tech Exploration = TS + HBA = 0.60.

Appendix 2

Robustness tests - The effect of IPR and experience on TS and HBA (Fixed effects regression – Host Countries with ≥5 Patents).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	TS	HBA	TS	HBA	TS	HBA	TS	HBA	TS	HBA	TS	HBA
Host-country IPR ^c	0.003	-0.024	0.002	-0.015	0.001	-0.017	0.004	-0.037	0.001	-0.025	0.010	-0.024
	[0.775]	[0.020]	[0.830]	[0.123]	[0.906]	[0.086]	[0.746]	[0.003]	[0.930]	[0.027]	[0.478]	[0.064]
Host-country IPR* Patenting experience in host country	-0.0001	0.001										
	[0.742]	[0.002]										
Host-country IPR* Innovation collaborations in host country			-0.00003	-0.0002								
			[0.938]	[0.609]								
Host-country IPR* Number of subsidiaries in host country					0.001	0.001						
					[0.434]	[0.266]						
Host-country IPR* patenting experience overseas							-0.0001	0.001				
							[0.792]	[0.004]				
Host-country IPR* Innovation collaborations overseas									0.001	0.004		
									[0.836]	[0.090]		
Host-country IPR* Number of overseas subsidiaries											-0.003	0.003
											[0.389]	[0.332]
Patenting experience in host country	-0.219	-0.005	-0.220	0.004	-0.220	0.003	-0.220	0.004	-0.220	0.003	-0.220	0.004
	[0.006]	[0.944]	[0.006]	[0.958]	[0.006]	[0.966]	[0.006]	[0.956]	[0.006]	[0.967]	[0.006]	[0.960]
Innovation collaborations in host country ^c	0.001	-0.001	0.001	0.001	0.001	-0.001	0.001	-0.001	0.001	-0.001	0.001	-0.001
	[0.112]	[0.289]	[0.686]	[0.752]	[0.118]	[0.372]	[0.114]	[0.314]	[0.118]	[0.343]	[0.113]	[0.370]

(continued on next page)

Appendix 2 (continued)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	TS	HBA	TS	HBA	TS	HBA	TS	HBA	TS	HBA	TS	HBA
Number of subsidiaries in host country ^a	0.011 [0.000]	0.002 [0.378]	0.011 [0.000]	0.002 [0.289]	0.004 [0.652]	-0.007 [0.429]	0.011 [0.000]	0.002 [0.368]	0.011 [0.000]	0.002 [0.315]	0.011 [0.000]	0.002 [0.319]
Overseas patenting experience	0.215 [0.007]	-0.003 [0.966]	0.215 [0.007]	-0.005 [0.951]	0.215 [0.007]	-0.004 [0.958]	0.216 [0.007]	-0.012 [0.873]	0.215 [0.007]	-0.004 [0.957]	0.215 [0.007]	-0.005 [0.952]
Overseas innovation collaborations ^{a,c}	0.021 [0.023]	0.008 [0.332]	0.021 [0.022]	0.008 [0.372]	0.021 [0.021]	0.008 [0.362]	0.021 [0.022]	0.008 [0.335]	0.017 [0.365]	-0.019 [0.285]	0.021 [0.022]	0.008 [0.378]
Number of overseas subsidiaries ^{b,c}	-0.002 [0.808]	0.006 [0.389]	-0.002 [0.803]	0.006 [0.359]	-0.002 [0.832]	0.007 [0.334]	-0.002 [0.812]	0.005 [0.433]	-0.002 [0.801]	0.006 [0.371]	0.014 [0.473]	-0.011 [0.562]
Firm R&D intensity ^c	0.026 [0.516]	0.141 [0.000]	0.026 [0.517]	0.141 [0.000]	0.026 [0.516]	0.141 [0.000]	0.026 [0.516]	0.141 [0.000]	0.026 [0.519]	0.140 [0.000]	0.026 [0.519]	0.141 [0.000]
Firm size ^{b,c}	0.045 [0.000]	0.033 [0.000]	0.045 [0.000]	0.034 [0.000]	0.045 [0.000]	0.034 [0.000]	0.045 [0.000]	0.034 [0.000]	0.045 [0.000]	0.034 [0.000]	0.045 [0.000]	0.034 [0.000]
Firm return on assets ^c	0.067 [0.003]	0.004 [0.841]	0.067 [0.003]	0.005 [0.814]	0.067 [0.003]	0.005 [0.813]	0.067 [0.003]	0.004 [0.862]	0.067 [0.003]	0.004 [0.837]	0.067 [0.003]	0.005 [0.815]
Cumulative innovation in host country ^{b,c}	-0.036 [0.000]	-0.045 [0.000]	-0.036 [0.000]	-0.048 [0.000]	-0.036 [0.000]	-0.047 [0.000]	-0.036 [0.000]	-0.046 [0.000]	-0.036 [0.000]	-0.047 [0.000]	-0.036 [0.000]	-0.047 [0.000]
Urbanization ^c	0.002 [0.504]	-0.001 [0.797]	0.002 [0.501]	-0.001 [0.818]	0.002 [0.471]	-0.0004 [0.851]	0.002 [0.513]	-0.0003 [0.909]	0.002 [0.494]	-0.0003 [0.900]	0.001 [0.525]	-0.001 [0.820]
ICT export ^c	0.001 [0.111]	-0.0003 [0.711]	0.001 [0.103]	-0.001 [0.497]	0.001 [0.095]	-0.0005 [0.544]	0.001 [0.108]	-0.0003 [0.680]	0.001 [0.100]	-0.0004 [0.600]	0.001 [0.105]	-0.001 [0.518]
Host-country R&D intensity ^c	-0.006 [0.699]	-0.023 [0.139]	-0.006 [0.693]	-0.024 [0.128]	-0.007 [0.678]	-0.023 [0.132]	-0.006 [0.696]	-0.022 [0.150]	-0.006 [0.700]	-0.022 [0.148]	-0.006 [0.691]	-0.022 [0.145]
Host-country innovation capacity ^{b,c}	0.032 [0.014]	0.016 [0.190]	0.033 [0.006]	0.001 [0.923]	0.035 [0.004]	0.004 [0.735]	0.032 [0.011]	0.013 [0.268]	0.034 [0.006]	0.006 [0.628]	0.033 [0.006]	0.002 [0.849]
_cons	-3.406 [0.002]	0.138 [0.895]	-3.414 [0.002]	0.221 [0.832]	-3.431 [0.002]	0.194 [0.853]	-3.419 [0.002]	0.260 [0.803]	3.414 [0.002]	0.221 [0.832]	-3.458 [0.002]	0.263 [0.801]
Year fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N (obs)	10,442	10,442	10,442	10,442	10,442	10,442	10,442	10,442	10,442	10,442	10,442	10,442
N (groups)	905	905	905	905	905	905	905	905	905	905	905	905
F stat	8.97 [0.000]	10.40 [0.000]	8.97 [0.000]	9.83 [0.000]	9.00 [0.000]	9.89 [0.000]	8.97 [0.000]	10.35 [0.000]	8.97 [0.000]	9.99 [0.000]	9.01 [0.000]	9.87 [0.000]

^a Notes: Logarithm transformed (overseas collaborations +1)

^b Logarithm transformed

^c one year lagged; p-values in brackets.

Appendix B. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.respol.2026.105427>.

Data availability

Data will be made available on request.

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