Are emerging market MNEs more attracted towards better patent enforcement regimes when undertaking greenfield R&D-focused FDI?*

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Abstract

Multinational enterprises in emerging markets (EMNEs), owing to weak enforcement of intellectual property rights (IPR), face challenges when undertaking domestic innovation. As a result, they may search for superior IPR environments in which to create greenfield projects focused on research and development (R&D) and innovation. We hypothesize that the likelihood that an EMNE chooses to invest in an R&D-focused greenfield project over other FDI projects is positively associated with increased levels of host-country patent enforcement protection relative to its home market. In addition, we hypothesize that EMNEs, many in the process of catching up through "springboard" FDI with developed-market MNEs (DMNEs), are more sensitive to IPR protection than DMNEs. Results of logistic regression modelling of 112,908 greenfield projects largely support our hypotheses. We discuss implications for understanding EMNE theorizing and policy, which has to date focused more on regulating technology-seeking mergers and acquisitions (M&As), overlooking the growing importance of R&D-related greenfield FDI as an effective firm-level catch-up strategy for EMNEs.

Keywords: greenfield FDI; firm-level catch-up; springboard theory; institutional arbitrage; intellectual property rights; strategic asset seeking

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1. Introduction

The strategic asset-seeking (hereafter SAS) orientation of MNEs from emerging markets (EMNEs) has become a hallmark feature of their motivation for outward foreign direct investment (FDI) (Meyer, 2015; Sutherland et al., 2020). This has driven a large and growing academic literature on the subject and spurred calls for extension of international business theories (Buckley et al., 2023; Paul and Feliciano-Cestero, 2021). In large-sample studies, EMNEs have been found to engage in higher levels of SAS FDI than developed-market MNEs (DMNEs) – both currently and adjusted for their stage of maturity (Jindra et al., 2016; Sutherland et al., 2020). Indeed, EMNEs "are considered highly active in acquiring foreign know-how, technologies and brands, with a view to catching up with developed market MNEs" (Wu et al., 2022, p.535).[1] Many of the places where EMNEs tend to locate their SAS-related FDI projects, moreover, are in favourable institutional environments, potentially compensating for their own domestic institutional voids – so-called "institutional arbitrage"-related FDI (Witt and Lewin, 2007). In addition to providing access to better institutional environments, such locations may also facilitate access to capabilities in the form of outstanding human resources, knowledge networks and supporting infrastructure, enabling them to develop the capabilities to engage in cutting-edge innovation (Lorenzen et al., 2020).

One of the primary theoretical lenses with which to view EMNEs' SAS FDI behaviour is the "general theory of springboard MNEs" (Luo and Tung, 2018; Paul and Feliciano-Cestero, 2021). A central tenet of springboard theory is its emphasis on rapid firm-level catch-up through SAS-related mergers and acquisitions (M&As) as a key means of building capability in EMNEs. Nonetheless, there is now growing recognition of the role of greenfield FDI projects related to research and development (R&D) as a mechanism to spur firm level catch-up (Wu et al., 2022). Indeed, Luo and Tung (2018) recently concluded that "thus far, most research has looked at [springboard] MNEs through the lens of M&As, while little attention has been paid to other important investment modes such as … greenfield investments" (Luo and Tung, 2018, p. 147). Anecdotally, however, there appear to be many notable examples of EMNEs that have successfully used R&D-related greenfield FDI in their catch-up strategies. This includes many well-known, high-profile cases such as Huawei and ZTE from China, as well as numerous other less talked about but equally successful cases (i.e. Infosys, Neuberg Diagnostics, Tata and Mahindra Groups (India), Mercado Libre (Argentina), Softtek (Mexico), Naspers (South Africa), Comcraft (Kenya) and Stefanini IT Solutions (Brazil)).

[1] The term "strategic assets" refers to critical resources or capabilities, including, for example, R&D capacity, proprietary technology, design facilities, brands and reputation, and distribution and production networks that give firms competitive advantages over others (Teece et al., 1997).

This raises several questions. Springboard theory suggests that EMNEs are considered to have a stronger SAS orientation than DMNEs, as they look to engage in rapid firm-level catch-up by building innovation (and other) capabilities through "aggressive" cross-border M&As (Luo and Tung, 2018). Do we therefore witness similar differences between EMNEs and DMNEs when it comes to SAS greenfield projects (i.e. related to R&D and to design, development and testing)? Moreover, if – as springboard theory suggests – EMNEs also engage in institutional arbitrage, do relatively superior institutional environments more strongly attract greenfield innovation offshoring by EMNEs than by DMNEs? If so, what types of superior institutions might differentially attract EMNEs (versus DMNEs)?

Here we focus primarily on protection of intellectual property rights (IPR). This is because IPR would appear a likely candidate to be associated with EMNEs' R&D-related greenfield FDI, given the ultimate purposes of such investment – namely to build a strong IPR portfolio in a well-guarded environment. We therefore conceptually and empirically explore the extent to which EMNEs' SAS-related greenfield FDI may be stronger than that of DMNEs; and whether superior home- or host-country IPR enforcement acts more strongly as a driver for EMNEs' choice of R&D FDI than for DMNEs' choice. We do so by employing logistic regression analysis of the FDI choices of 112,908 greenfield projects worldwide, comparing EMNEs with DMNEs. Our results show that better IPR enforcement does indeed more strongly attract greenfield R&D by EMNEs. We discuss how our findings contribute to the debate on EMNE catch-up within international business theory (including springboard theory). From a policy perspective, we argue that the recent focus has mainly been on controlling technology-seeking springboard-type M&As from emerging markets to developed ones. Greenfield FDI related to R&D has been largely overlooked by policymakers from developed markets, despite its rapid expansion and growing importance to EMNEs as a means of facilitating firm-level catch-up.

2. Theory and hypothesis development

EMNEs, some argue, do not possess traditional types of "ownership advantages" that can be meaningfully exploited in developed markets (Cuervo-Cazurra, 2012). This being so, their outward FDI strategies are considered poorly explained by existing theory, prompting calls for new or revised theoretical contributions to explain their FDI strategies (Luo and Tung, 2018). EMNE SAS strategies, in particular, are thought to be driven by the comparatively low levels of strategic assets they possess when compared with their DMNE competitors (Luo and Tung, 2007; Rui and Yip, 2008), as they look to rapidly catch up with DMNEs (Rui and Yip, 2008), aided at times by State support (Wang et al., 2012) and a number of additional favourable conditions in their domestic home markets. These include access to “complementary local resources”, allowing them to fully exploit their home market (Hennart, 2012); asymmetries in liabilities of foreignness, hindering foreign businesses looking to compete in emerging markets but not impeding EMNEs from going out (Petersen and Seifert, 2014); business group affiliation, aiding EMNE groups in exploiting their home market more effectively (i.e. internal product, labour and finance markets) (Yiu et al., 2007); and the imperative to catch up and learn from foreign rivals (Child and Rodrigues, 2005; Mathews, 2006). State-led institutional supports (at various levels) may therefore encourage their international SAS expansion, through – among other things – support for domestic financial markets (Wang et al., 2012). This includes active industrial policies to encourage nascent EMNEs to engage in cross-border SAS, particularly in the case of Chinese MNEs (Cui and Jiang, 2012; Deng, 2009; Luo et al., 2010; Wang et al., 2012). EMNEs, moreover, have been considered especially capable of competing in the “middle of the pyramid” income groups in both their home and other emerging markets, offering outstanding performance-to-cost ratios in the “fight for the middle” (Brandt and Thun, 2010). They also have developed “compositional capabilities” and exploit the advantages of ambidexterity, which allow them to more effectively transfer and exploit relevant knowledge in these markets than DMNEs (Yamin, 2023; Yamin and Sinkovics, 2015). In short, the internationalization strategies of EMNEs have led, in some instances, to significant improvements in their performance and competitiveness.

2.1 Greenfield FDI and R&D innovation offshoring (SAS) orientation: EMNEs versus DMNEs

While the SAS orientation of EMNEs has risen to theoretical prominence among international business scholars (Luo and Tung, 2018; Mathews, 2017; Sutherland et al., 2020), it is of interest to note that the role of the greenfield establishment mode has generally been downplayed and under-researched in that literature (Schaefer, 2020). This is probably because SAS greenfield approaches are considered less “aggressive”, less high profile and generally more incremental in their nature. A greenfield FDI project, for example, typically involves a single site in a specific location, such as Huawei establishing an R&D subsidiary in Stockholm, initially with only a small number of employees. Unsurprisingly, such greenfield FDI is often less widely covered in worldwide media reporting, as it is politically less consequential than a billion-dollar-plus mega-merger involving a target firm with multiple subsidiaries. Greenfield data sets, moreover, have been less easily accessible through mainstream academic research institutions, whereas M&A data is commonly available. However, the underlying logic and rationale applied to the motivating role of firm-level catch-up, as popularized in the springboard and “LLL” perspectives (Mathews, 2006; Luo and Tung, 2007), would appear to be equally relevant to the case of SAS-related greenfield FDI. If EMNEs are in a rush to engage in firm-level catch-up and accelerated internationalization – as exemplified by “aggressive” acquisitions to developed markets – would they not also look to engage in greenfield R&D more enthusiastically than DMNEs?

Can EMNEs benefit from SAS R&D-related greenfield FDI to engage in “innovation offshoring”? Innovation offshoring – “the foreign sourcing of knowledge-intensive activities as inputs to the innovation process” – has indeed been found to be of particular benefit to innovation performance in EMNEs (Rosenbusch et al., 2019, p. 203). Recent research shows how such FDI strategies have looked to (i) tap into local R&D infrastructure (Schaefer, 2020; Zhang et al., 2017); (ii) engage in “technological scanning” to track the latest technological developments in developed markets, helping plan future investments (Zhang et al., 2017); (iii) establish new technology partnerships and networks, to make use of “external technological assistance by building or strengthening new or existing local cooperative relationships” (with both well-known large businesses as well as lesser known smaller ones) (Zhang et al., 2017) and universities and research centres (Liefner et al., 2019); (iv) interact with the aforementioned technology leaders; (v) recruit highly trained foreign research personnel and integrate them into the EMNEs’ organizational structure and fabric – creating deep networks and linkages with key human resources related to R&D (Schaefer, 2020; Schaefer and Liefner, 2017); and (vi) develop mechanisms for managing foreign R&D personnel, often involving frequent meetings and exchanges (Schaefer, 2020). Indeed, recruitment of highly trained personnel is perhaps unsurprisingly “among the most important technology-driven motives for setting up overseas R&D units” (Zhang et al., 2017).

This is supported by Schaefer et al.’s detailed case study of Huawei, which “turned abroad to access state-of-the-art knowledge” because it “had little left to learn in its home country” (Schaefer, 2020, p. 1501). Huawei’s success is now in large part seen as related to “hiring non-locals who are culturally and professionally embedded in the international industry networks” (Schaefer, 2020, p. 1510). The Chinese MNEs Huawei and ZTE stand out as significant cases in point. They rely extensively upon foreign hires in international R&D centres in institutionally advanced developed markets (Schaefer and Liefner, 2017). By 2018, Huawei (with 116 R&D centres) and ZTE (with 28) – China’s largest MNE investors in greenfield R&D by some distance – had established more than 144 SAS greenfield R&D centres. Most of Huawei’s most-cited patents, moreover, do not originate from China, but rather from its dozens of foreign R&D outposts (Schaefer, 2020), pointing towards the great strategic importance of these offshore R&D hubs for successful EMNEs. Other case study evidence supports the view that EMNEs can successfully engage in overseas greenfield FDI, facilitating capability-building and firm-level catch-up. This includes Tata Group (Becker-Ritterspach and Bruche, 2012), Infosys (Kimble, 2013), Naspers (Teer-Tomaselli et al., 2019) and Mahindra (Ramaswamy and Chopra, 2014).

To date, there has been huge academic and policy interest in the "aggressive" springboard-type M&As used as a vehicle for EMNEs to catch up with DMNEs (Luo and Tung, 2018). Yet there is also a strong rationale for EMNEs to engage in R&D-related greenfield FDI, as it allows them to tap into key resources and institutional environments required to support innovation. This raises the question of whether EMNEs are more inclined to undertake R&D-related greenfield FDI than DMNEs, which leads to our first hypothesis.

> *Hypothesis 1* (H1): When undertaking greenfield FDI projects, EMNEs are more predisposed to establish R&D-related projects than are DMNEs.

2.2 EMNEs and DMNEs, institutional arbitrage and IPR enforcement

Springboard theory highlights the role of institutional arbitrage as a key driver of EMNEs' springboard outward FDI; however, the theory is surprisingly silent on the specific *types* of institutions that EMNEs seek. It may potentially be refined by considering this question. We argue that SAS motives typically involve efforts to build up rare and valuable firm-level capabilities (for example, sourcing knowledge by attracting the best human resources or scientific talent) that allow an MNE to become innovative and, eventually, internationally competitive (Awate et al., 2015). Such capability-building activities typically involve high levels of investment in the newly created foreign subsidiaries (Hansen et al., 2016; He et al., 2018). If this is so, availing of IPR-related institutions that are favourable to guarding innovation-related investments may be of considerable value for springboard EMNEs. Indeed, recent research shows that IPR-related institutional arbitrage has a significant impact on innovation performance for EMNEs (Rosenbusch et al., 2019).

Moreover, firms also take great interest not only in "book laws" on patent protection, but also in enforcement of these laws (Papageorgiadis and Sofka, 2020). The extent to which such laws are implemented (as opposed to just enacted) determines the effectiveness of IPR protection. Contract enforcement is therefore also considered crucial for innovation activities to take place (Papageorgiadis and Sofka, 2020). It facilitates firms investing in R&D activities by allowing them to earn rents from the IPR investments they make and guarding against illegal appropriation by others (i.e. by former employees or competitors). IPR enforcement, in short, greatly affects the ability of a firm to appropriate market rents associated with innovation (Bruno et al., 2021; Rosenbusch et al., 2019).

Case study evidence suggests that innovation offshoring involves a long-term commitment to employment of highly trained foreign personnel, access to scientific infrastructure and educational resources, related networks and more generally location-bounded knowledge clusters and global centres of excellence in settings where enforcement of IPR is strong (Schaefer, 2020; Wu et al., 2022). All MNEs increasingly seek to expose themselves to such locations through innovation offshoring (Cano-Kollmann et al., 2016). By comparison with mature DMNEs, however, which typically already have significant exposure to locations with strong IPR enforcement (through their portfolio of R&D-intensive subsidiaries, including domestic ones), "infant" EMNEs do not. When engaging in rapid firm-level catch-up (Cuervo-Cazurra, 2012), they may therefore attempt to become more like their DMNE counterparts, specifically by increasing their exposure to environments with strong IPR enforcement. A strong IPR enforcement environment thus becomes of greater importance to EMNEs (versus DMNEs) owing to (i) their current underexposure to such environments, which can protect their investment in innovation capability-building and (ii) their stronger (versus DMNEs) need to invest heavily in building firm-level capabilities related to catch-up (where such investments are best guarded in IPR environments with strong enforcement). We therefore posit that IPR-related institutional arbitrage motives (i.e. the difference in institutional quality between home and host) are likely to be a stronger, not weaker, driver of the choice to establish R&D-related greenfield subsidiaries for EMNEs than for DMNEs.

> *Hypothesis 2* (H2): Superior patent enforcement measures between home and host country will more positively influence the choice to set up an R&D-related greenfield subsidiary for EMNEs than for DMNEs.

3. Methods

3.1 Data and sample

The fDi Intelligence's fDi Markets project database draws on press releases, newspaper reports and information from local and national investment agencies, as well as investing firms, to record details on 200,000-plus greenfield investments made worldwide between 2003 and 2021. The database is commonly used to track greenfield FDI around the globe in empirical studies exploring such FDI (De Beule and Somers, 2017; Yang and Bathelt, 2021). Information reported includes the investing firm or parent company, the sector, the country of origin and of destination, the volume of FDI and number of employees, as well as the type of activity for each investment (e.g. R&D, design and testing; education and training; logistics, distribution and transportation).

A logistic regression analysis is employed to estimate the relative likelihood of an MNE engaging in a SAS-type FDI project (in this case, designated as R&D or design, development and testing (DDT)) relative to all other FDI types. By including a dummy variable for EMNEs, we investigate whether EMNEs are more likely to engage in SAS-type greenfield FDI projects than their DMNE counterparts (H1).

Including a continuous variable for the Patent Enforcement Index (PEI) home–host difference (PEIDiff) allows us to ascertain the impact of PEI differences between home and host through the interaction of this continuous variable with the EMNE dummy variable (H2).

3.2 Dependent variable

As noted, we assign a value of one to our binary dependent variable when the FDI project is classified as "R&D" or "design, development and testing", and a value of zero for other types of projects. Our approach follows some earlier studies that also have used the fDi Markets database (Castellani and Lavoratori, 2020; Guimón et al., 2018). Castellani and Lavoratori (2020) argue that both types of activities are viewed as competence- or capability-creating activities associated with innovation activities. Both R&D and design, development and testing subsidiaries combined have been used to capture strategic asset-related activity (De Beule and Somers, 2017), and both have been considered as an appropriate proxy for subsidiaries involved in innovation activities (Castellani and Lavoratori, 2020).

3.3 Independent variables

Various indices have been employed to compare the strength and quality of patent systems across countries in international business research. To date, however, nearly all approaches have relied upon the use of "book laws" as an indicator of IPR quality in a national jurisdiction. Looking only at book law is problematic, however, as "most variance across countries emerges during the actual processes of enforcement" (Papanastassiou et al., 2020, p. 1). The Patent Enforcement Index (PEI) captures the differences in actual patent enforcement for 51 countries. It relies upon relatively comprehensive firm-level enforcement data (Papanastassiou et al., 2020). The PEI itself is subdivided into three sub-indices for more granularity: the ease of patent administration, the efficiency of courts and law enforcement for effectively punishing infringement and the availability of data for identifying infringement (Papanastassiou et al., 2020). Here we use the average of these three subcomponents, calculated for both host and home countries, so as to estimate the PEI difference (i.e. subtracting the PEI of the home from the host or destination). Thus, an EMNE investing in a developed market with a better patent enforcement regime would constitute a positive PEI difference.

A dummy variable (EMNE, table 1) captures whether the FDI project is of emerging-market origin (EMNE FDI project = 1; DMNE FDI project = 0). Our classification of emerging- and developed-market economies corresponds to that used by the International Monetary Fund (IMF). The IMF *World Economic Outlook* classifies 39 economies as "advanced" (based on such factors as high per capita income, exports of diversified goods and services, and international integration within a particular region or country) and all remaining countries as “emerging-market and developing” economies. Among these, 40 are in addition considered “emerging-market and middle-income” economies by the *IMF Fiscal Monitor*. Here we consider all economies listed as advanced by the *IMF World Economic Outlook Database* as homes to DMNEs. All others, including those falling under the emerging-market and middle-income category, we consider as homes of EMNEs.[2] DMNEs thus originate from Australia, Austria, Belgium, Canada, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong (China), Iceland, Ireland, Israel, Italy, Japan, the Kingdom of the Netherlands, New Zealand, Norway, Portugal, the Republic of Korea, Singapore, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan Province of China, the United Kingdom and the United States. EMNEs include the following countries: Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Jordan, Malaysia, Mexico, the Philippines, Poland, the Russian Federation, South Africa, Romania, Thailand, Türkiye and Ukraine. Note that data availability restricts our sample size for both EMNEs and DMNEs, which is therefore not exhaustive. A detailed breakdown of the destination countries and distribution by parent investors is provided in table 2.

Table 1. Description of variables and data source

Abbreviation	Name	Measurement	Data source
R&D/DDT	R&D/DDT investment	1 = DDT and R&D investments; 0 = other investments.	fDi Intelligence, fDi Markets project database, 2003–2021.
EMNE	EMNE dummy variable	1 = if the parent firm is from an emerging market economy; 0 = if the parent firm is from an developed market economy.	International Monetary Fund, World Economic Outlook Database, April 2023, www.lmf.org.
PEIDiff	PEI difference	Patent Enforcement Index (PEI) difference, host minus home PEI measure.	Papageorgiadis and Sofka (2020).
HmPEI	PEI, home country	Sourcing countries' PEI.	Papageorgiadis and Sofka (2020).
GlbCity	Global city	1 = if the host city is a "global city"; 0 = all other cities.	Loughborough University, “Globalization and World Cities (GaWC)”, www.lboro.ac.uk/microsites/geography/gawc/data.html (accessed on 11 January 2022).
TechClus	Technological cluster	1 = top-ranked technological cluster at city level; 0 = all other cities.	Cornell University, INSEAD and the WIPO, Global Innovation Index 2021, www.globalinnovationindex.org.

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[2] For further details, see IMF, World Economic Outlook database, April 2023.

Table 1. Description of variables and data source (Concluded)

Abbreviation	Name	Measurement	Data source
CapInv	Capital investment	Capital invested in the foreign subsidiary, value in millions of United States dollars.	fDi Intelligence, fDi Markets project database, 2003–2021.
JobsCrt	Jobs created	Number of jobs created in the foreign subsidiary.	fDi Intelligence, fDi Markets project database, 2003–2021.
FrmExp	Firm's prior experience	Parent company's prior experience in the host country.	fDi Intelligence, fDi Markets project database, 2003–2021.
CapCity	Capital city	1 = if the host city is the national capital city; 0 = all other cities.	WorldData.info, "All capitals in the world", www.worlddata.info (accessed on 24 January 2022).
InstHost	Institutions, host country	Destination country's institutional quality.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
LogGDP	Logarithm of GDP	Logarithm of gross domestic product (GDP).	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
InnoHost	Innovation, host country	Global Innovation Index rank of the destination country.	Cornell University, INSEAD and WIPO, "Global Innovation Index 2021", www.globalinnovationindex.org.
LawHost	Rule of law, host country	Average rule of law quality.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
GRHost	Growth rate, host country	Speed of growth in destination country.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
BusEase	Ease of starting a business	Index/survey based on World Bank questionnaire.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
ValInt	Value of intangibles	Total value, constant United States dollars.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
InstQ	Institutional quality	Average institutional quality measure based on World Bank data.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
TradeSc	Scale of trade	Scale of trade, real values.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
R&DExp	R&D expenditure	Measure of R&D expenditures in destination country.	World Bank, WDI Database, www.worldbank.org (accessed on 5 December 2022).
Ind	Industry	Dummy variables.	fDi Intelligence, fDi Markets project database, 2003–2021.
Yr	Year	Dummy variables.	fDi Intelligence, fDi Markets project database, 2003–2021.

Source: Authors' compilation.

Table 2. Distribution by EMNE/DMNE home and destination countries

Destination country	EMNE greenfield FDI projects	EMNE sub-samples					DMNE greenfield FDI projects	DMNE sub-samples		
		China	Russian Federation	India	Brazil	Other EMNEs		United States	United Kingdom	Other DMNEs
Argentina	136	6	4	4	67	55	604	238	25	341
Australia	212	80	4	69	2	57	2 871	1 233	420	1 218
Austria	49	16	10	2	2	19	780	108	26	646
Belgium	152	58	9	39	6	40	1 712	482	132	1 098
Brazil	276	84	15	54	-	123	2 652	903	162	1 587
Canada	167	52	9	53	16	37	2 969	1 599	231	1 139
Chile	73	12	-	4	14	43	450	129	28	293
China	438	-	58	121	40	219	12 339	3 653	571	8 115
Colombia	158	15	-	13	23	107	632	237	33	362
Czechia	77	24	14	14	-	25	1283	243	87	953
Denmark	69	33	1	17	-	18	838	200	77	561
Estonia	12	1	7	2	-	2	224	27	13	184
Finland	91	25	36	21	-	9	940	173	56	711
France	330	145	21	53	16	95	5 059	1 504	429	3 126
Germany	1 595	720	123	186	18	548	7 677	2 138	626	4 913
Greece	15	9	1	2	-	3	199	42	35	122
Hungary	95	34	1	24	2	34	1 551	284	80	1 187
Iceland	1	-	-	-	-	1	17	9	3	5
India	345	181	27		13	124	7 360	3 155	597	3 608
Indonesia	143	53	2	23	-	65	791	122	26	643
Ireland	59	27	2	15	1	14	1 910	1 170	277	463
Israel	24	9	5	4	1	5	379	257	15	107
Italy	92	44	5	14	1	28	1 296	349	117	830
Japan	167	80	17	28	4	38	1 725	813	123	789

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Table 2. Distribution by EMNE/DMNE home and destination countries (Concluded)

Destination country	EMNE greenfield FDI projects	EMNE sub-samples: China	Russian Federation	India	Brazil	Other EMNEs	DMNE greenfield FDI projects	DMNE sub-samples: United States	United Kingdom	Other DMNEs
Jordan	15	7	1	3	1	3	82	30	5	47
Malaysia	118	55	7	29	-	27	1 263	308	132	823
Mexico	239	93	3	45	37	61	3 585	1 479	121	1 985
Netherlands, Kingdom of the	245	84	16	65	6	74	2 102	903	214	985
New Zealand	24	11	-	8	-	5	317	96	42	179
Norway	11	4	1	2	1	3	278	61	54	163
Philippines	83	21	1	16	-	45	646	226	45	375
Poland	127	38	16	25	1	47	3 022	579	222	2 221
Portugal	46	4	-	4	29	9	576	78	46	452
Republic of Korea	56	35	9	5	2	5	1 074	425	49	600
Romania	141	22	20	11	8	80	1 521	263	109	1 149
Russian Federation	313	92	-	37	6	178	2 613	515	122	1 976
Slovakia	36	8	3	4	1	20	691	102	28	561
Slovenia	17	6	3	1	-	7	131	10	5	116
South Africa	121	49	10	50	3	9	900	278	140	482
Spain	274	61	17	30	26	140	3 807	809	372	2 626
Sweden	56	26	7	14	1	8	799	226	67	506
Switzerland	84	24	16	27	7	10	981	380	46	555
Thailand	133	53	1	30	-	49	1 574	259	57	1 258
Türkiye	105	30	18	22	11	24	1 512	272	94	1 146
Ukraine	122	7	59	3	1	52	449	91	32	326
United Kingdom	574	158	27	170	23	196	4 979	2 118	-	2 861
United States	1 575	558	52	392	163	410	14 380	-	2 159	12 221
Venezuela, Bolivarian Republic of	19	3	5	2	3	6	58	21	2	35
Total	9 310	3 157	663	1 757	556	3 177	103 598	28 597	8 352	66 649

Source: Authors' caculations, based on fDi Markets project database.

3.4 Control variables

We controlled for factors that may influence the choice of R&D greenfield FDI, including those linked to the firm (industry, size, year etc.) and the host-country destination (i.e. technology levels, presence of innovative clusters, ease of business or general institutional development, and so on) and home- and host-country differences (i.e. patent enforcement index superiority in host versus home). First, however, of considerable importance is the overall level of innovativeness of the host economy where an FDI project takes place. R&D FDI projects will be attracted to more innovative economies. Those economies that are innovative, however, may also have better patent enforcement protection. To attempt to tease out the impacts of patent enforcement regimes, we therefore introduce a number of variables to control for the overall innovativeness of the host economy. As in similar studies, we employ the widely used Global Innovation Index (GII) (Yoo and Reimann, 2017). This captures the strength of the national innovation ecosystem, measuring innovation activity in terms of both World Intellectual Property Organization (WIPO) patents and educational attainment. Specifically, innovation capability is measured according to fractional counting, based on both the number of patents issued by inventors and the scientific articles published by authors. The WIPO's GII ranking thus includes education, infrastructure and knowledge creation (Kerr and Robert-Nicoud, 2020; Rehman et al., 2020; Yu, 2021).

In addition, we introduce the value of the host economy's intangible assets and national R&D expenditures (World Bank, WDI database), which may attract greenfield R&D investment. Knowledge and innovation capabilities, moreover, are often concentrated in clusters (agglomerations) of activity, such as in global cities and high-tech clusters. Subnational factors also, therefore, play a part in attracting greenfield R&D FDI (Chakravarty et al., 2021). To control for local agglomeration impacts, we include subnational city-level controls (which data in the fDi Markets database allows us to do). FDI scale is measured by host-country subsidiaries' employees as a scale control (Hu et al., 2021). General overall institutional quality (rule of law, political stability, etc.) in the host country affects its attractiveness to foreign investors undertaking greenfield FDI (Nielsen et al., 2017; Yang, 2018). Investment may be affected by risks and additional costs in a weak institutional environment (Nielsen et al., 2017; Yang, 2018). To control for the institutions of the host country, we followed the methodology of Marano et al. (2017) and employed principal component analysis to create a composite measure of the six worldwide governance indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and absence of corruption (Marano et al., 2017). In addition, we controlled for the amount of capital invested, which may affect decisions regarding R&D investment (Lai et al., 2015). The host country's international experience can potentially affect the FDI strategy, which is assessed by the cumulative investments made by a firm in destination countries between 2003 and 2021. Furthermore, we accounted for economic influences: a natural logarithm of the gross domestic product (GDP) was used to control for the size of the local market (Banalieva et al., 2018; Hutzschenreuter and Harhoff, 2020). Finally, we incorporate the PEI of the source country, as that country's institutional environment could influence SAS activities, through institutional evasion, flight or arbitrage.

3.5 Model

Given our focus on estimating the likelihood of an MNE's choice of SAS FDI (over other types of FDI), for our analysis we employ binary logistic modelling with robust standard errors, clustered by year and industry. This methodology is widely used in international business studies (Belderbos et al., 2020) and utilizes the maximum likelihood estimation technique (Fischer, 1973).

$$\begin{aligned}&Probability(R\&D_i / DDT_i = 1; Others_i = 0)\\&=f(HmPEI_i, JobsCrt_i, InnoHost_i, LawHost_i, GRHost_i, BusEase_i, CapInv_i,\\&ValInt_i, InstQ_i, TradeSc_i, R\&DExp_i, GlbCity_i, TechClus_i, CapCity_i, InstHost_i,\\&FrmExp_i, LogGDP_i, PEIDiff_i, EMNE_i, EMNE_i, *PEIDiff_i, Industry_i, Year_i)\end{aligned}$$

As indicated in the model, i represents companies. We hypothesize that the propensity of a firm i to engage in R&D investment is significantly influenced by the country of its origin. Moreover, we examine interaction variables, with a special emphasis on the difference in the PEI between the destination and source countries.

4. Results

Table 3 provides a correlation matrix and descriptive statistics. To minimize large correlations, we use a mean-centred approach when including interaction terms. For all models the mean variance inflation factor (VIF) was less than 10, indicating that collinearity did not present serious issues for inferring statistical significance (Cohen et al., 2013; Hair et al., 2010). We adopt reporting of odds ratios (table 4b) as well as coefficients (table 4a), as per Bowen and Wiersema (2004). Coefficients in non-linear models can only indicate directions and odds ratios are typically used to interpret logit models (an odds ratio of greater than 1 suggests an increase in likelihood associated with that variable, if it is significant). Based on statistical analysis of model fit data, models B and C also show lower log pseudo-likelihood and Akaike Information Criterion (AIC) values than model A (not including the PEIDiff variable and interactions). This implies an increased effectiveness in these models (Wulff, 2015).

Table 3. Descriptive statistics and pairwise correlations

Variable	Observation	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
R&D/DDT	112 908	0.103	0.304	1																				
EMNE	112 908	0,082	0.275	-0.008***	1																			
PEIDiff	112 908	-1.452	2.605	-0.034***	0.456***	1																		
HmPEI	112 908	7.576	1.469	0.038***	-0.748***	-0.554***	1																	
JobsCrt	112 908	125.926	320.309	-0.006**	-0.013***	-0.150***	-0.024***	1																
InnoHost	112 908	49.863	9.689	-0.027***	0.025***	0.714***	0.006*	-0.167***	1															
LawHost	112 908	68.282	24.509	-0.023***	0.042***	0.790***	0.006**	-0.214***	0.813***	1														
GRHost	112 908	61.147	12.719	0.075***	-0.074***	-0.441***	0.046***	0.181***	-0.271***	-0.602***	1													
BusEase	112 908	86.397	7.461	-0.054***	0.002	0.439***	0.020***	-0.147***	0.581***	0.610***	-0.436***	1												
CapInv	112 908	58.771	274.664	-0.016***	0.007**	-0.037***	-0.020***	0.325***	-0.053***	-0.066***	0.051***	-0.037***	1											
ValInt	112 908	49.63	8.694	-0.016***	-0.002	0.308***	0.008**	-0.063***	0.622***	0.291***	0.214***	0.170***	-0.022***	1										
InstQ	112 908	74.23	14.158	-0.040***	0.038***	0.761***	0.007**	-0.212***	0.817***	0.969***	-0.645***	0.723***	-0.064***	0.249***	1									
TradeSc	112 908	80.195	8.057	-0.018***	0.009***	0.306***	-0.019***	-0.025***	0.550***	0.214***	0.175***	0.064***	-0.004	0.374***	0.201***	1								
R&DExp	112 908	3 745.41	3 972.892	-0.033***	0.058***	0.499***	-0.049***	-0.089***	0.705***	0.465***	-0.112***	0.130***	-0.032***	0.362***	0.434***	0.818***	1							
GlbCity	112 908	0.403	0.491	0.037***	-0.008***	-0.056***	0.014***	-0.067***	-0.035***	-0.097***	0.195***	-0.080***	-0.053***	0.160***	-0.107***	-0.025***	-0.116***	1						
TechClus	112 908	0.309	0.462	0.009***	-0.015***	0.073***	0.019***	-0.065***	0.206***	0.037***	0.170***	-0.003	-0.044***	0.292***	0.030***	0.233***	0.141***	0.604***	1					
CapCity	112 908	0.19	0.392	-0.018***	0.013***	-0.012***	-0.005*	-0.088***	-0.016***	0.030***	-0.055***	0.101***	-0.048***	0.019***	0.044***	-0.209***	-0.174***	0.548***	0.215***	1				
InstHost	112 908	0.752	0.827	-0.028***	0.041***	0.757***	0.007**	-0.214***	0.745***	0.979***	-0.670***	0.603***	-0.066***	0.236***	0.962***	0.111***	0.382***	-0.101***	0.001	0.046***	1			
LogGDP	112 908	8.071	1.42	0.023***	-0.011***	-0.007**	-0.012***	0.072***	0.172***	-0.196***	0.447***	-0.323***	0.023***	0.186***	-0.233***	0.867***	0.629***	0.028***	0.221***	-0.245***	-0.298***	1		
FrmExp	112 908	0.754	2.407	0.076***	-0.052***	-0.097***	0.051***	0.075***	-0.060***	-0.081***	0.088***	-0.042***	0.063***	-0.016***	-0.079***	-0.020***	-0.045***	0.003	-0.020***	-0.027***	-0.077***	0.014***	1	
Yr	112 908	2 012.89	5.372	0.013***	0.066***	0.179***	-0.035***	-0.145***	0.133***	0.194***	-0.195***	0.118***	0.042***	0.026***	0.189***	0.035***	0.069***	-0.021***	-0.002	0.030***	0.185***	-0.053***	0.141***	1

Source: Authors' estimations.
Note: Pairwise correlations are statistically significant at *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4a. Logistic regression for SAS greenfield investments (coefficients), 2003–2021

R&D/DDT investment	Model A	Model B	Model C
HmPEI	-0.121*** (0.024)	-0.037 (0.026)	-0.033 (0.026)
JobsCrt	0.000*** (0.000)	0.000* (0.000)	0.000* (0.000)
InnoHost	0.050*** (0.005)	0.051*** (0.005)	0.051*** (0.005)
LawHost	0.019*** (0.004)	0.019*** (0.004)	0.019*** (0.004)
GRHost	0.020*** (0.001)	0.020*** (0.001)	0.020*** (0.001)
BusEase	-0.002 (0.003)	-0.002 (0.003)	-0.002 (0.003)
CapInv	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
ValInt	-0.018*** (0.003)	-0.018*** (0.003)	-0.018*** (0.003)
InstQ	-0.028*** (0.006)	-0.028*** (0.006)	-0.029*** (0.006)
TradeSc	-0.067*** (0.006)	-0.067*** (0.006)	-0.067*** (0.006)
R&DExp	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
GlbCity	0.145*** (0.032)	0.145*** (0.032)	0.144*** (0.032)
TechClus	-0.297*** (0.030)	-0.295*** (0.030)	-0.295*** (0.030)
CapCity	-0.497*** (0.034)	-0.498*** (0.035)	-0.494*** (0.034)
InstHost	0.378*** (0.088)	0.392*** (0.088)	0.385*** (0.088)
FrmExp	0.078*** (0.004)	0.079*** (0.004)	0.078*** (0.004)
LogGDP	0.442*** (0.036)	0.449*** (0.036)	0.447*** (0.036)
PEIDiff	-0.156*** (0.023)	-0.164*** (0.023)	-0.173*** (0.023)
EMNE		0.622*** (0.062)	0.325*** (0.074)
EMNE*PEIDiff			0.134*** (0.016)
_cons	-1.565*** (0.279)	-2.375*** (0.292)	-2.384*** (0.293)
Observations	112 908	112 908	112 908
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Wald Chi-square	6 475.72	6 524.87	6 564.88
Log pseudolikelihood	-32 548.23	-32 500.20	-32 468.75
Akaike's information criterion	65 242.46	65 148.39	65 087.49
Pseudo R-square	0.129	0.130	0.131
Mean variance inflation factor	6.14	6.10	6.06

Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4b. Logistic regression for SAS greenfield investments (odds ratio), 2003–2021

R&D/DDT investment	Model A	Model B	Model C
HmPEI	0.886*** (0.021)	0.964 (0.025)	0.968 (0.025)
JobsCrt	1.000** (0.000)	1.000* (0.000)	1.000* (0.000)
InnoHost	1.051*** (0.006)	1.052*** (0.006)	1.052*** (0.006)
LawHost	1.019*** (0.004)	1.019*** (0.004)	1.019*** (0.004)
GRHost	1.020*** (0.001)	1.021*** (0.001)	1.020*** (0.001)
BusEase	0.998 (0.003)	0.998 (0.003)	0.998 (0.003)
CapInv	0.999*** (0.000)	0.999*** (0.000)	0.999*** (0.000)
ValInt	0.982*** (0.003)	0.982*** (0.003)	0.982*** (0.003)
InstQ	0.972*** (0.006)	0.972*** (0.006)	0.971*** (0.006)
TradeSc	0.935*** (0.005)	0.935*** (0.005)	0.935*** (0.005)
R&DExp	1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)
GlbCity	1.156*** (0.037)	1.156*** (0.037)	1.155*** (0.037)
TechClus	0.743*** (0.022)	0.745*** (0.022)	0.744*** (0.022)
CapCity	0.608*** (0.021)	0.608*** (0.021)	0.610*** (0.021)
InstHost	1.459*** (0.129)	1.481*** (0.131)	1.469*** (0.130)
FrmExp	1.081*** (0.004)	1.082*** (0.004)	1.081*** (0.004)
LogGDP	1.555*** (0.055)	1.566*** (0.056)	1.563*** (0.056)
PEIDiff	0.856*** (0.020)	0.849*** (0.020)	0.841*** (0.020)
EMNE		1.863*** (0.116)	1.383*** (0.102)
EMNE*PEIDiff			1.143*** (0.019)
_cons	0.209*** (0.058)	0.093*** (0.027)	0.092*** (0.027)
Observations	112 908	112 908	112 908
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Wald Chi-square	6 475.72	6 524.87	6 564.88
Log pseudolikelihood	-32 548.23	-32 500.20	-32 468.75
Akaike's information criterion	65 242.46	65 148.39	65 087.49
Pseudo R-square	0.129	0.130	0.131
Mean variance inflation factor	6.14	6.10	6.06

Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

In tables 4a and 4b (reporting coefficients and odds ratios respectively), the logistic estimates for hypotheses 1 and 2 are presented. Model A shows that most of the control variables have the expected sign and are significant. SAS greenfield FDI continued to be attracted to a country by prior experience (FrmExp) and advanced institutional environments (InstHost) as indicated by positive odds ratios (oRs) of 1.081 and 1.459, respectively. These results indicate that investors have been attracted to SAS greenfield FDI because of experience and an advanced institutional environment. In addition, the odds ratio of a global city (GlbCity) is greater than 1 and significant at the 0.1 per cent level, indicating that cities with a high concentration of knowledge-intensive research are likely to be the most attractive locations for SAS greenfield projects.

Table 5. Average marginal effects

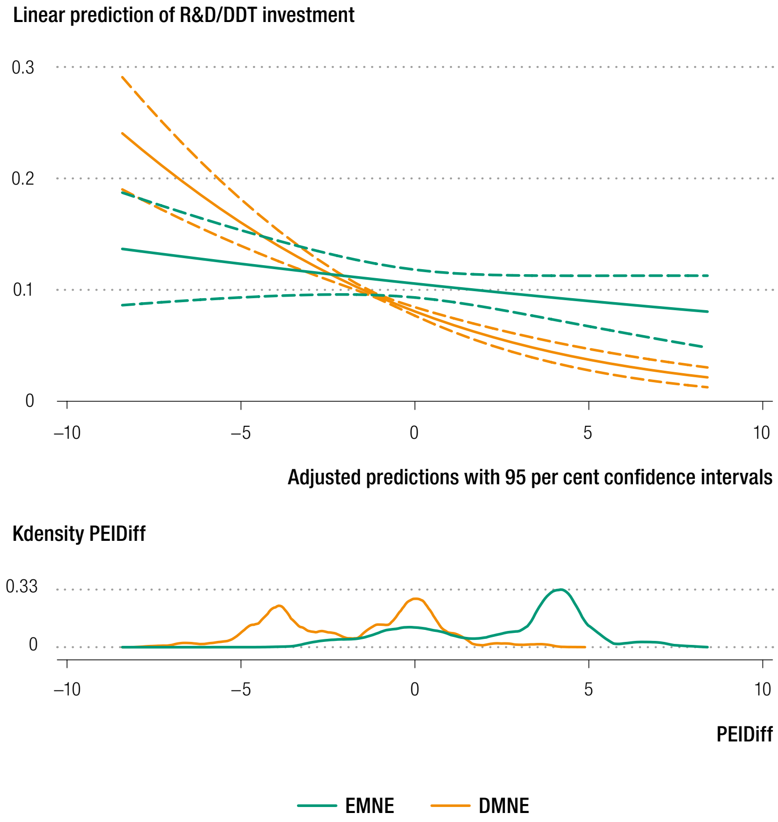
Term	Hypothesis	SAS_dy/dx
EMNE	H1	0.027***(0.000)
EMNE* PEIDiff	H2	0.011***(0.000)

Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$.

Table 4a shows that the coefficient ratio of the EMNE dummy variable was significant and positive ($\beta = 0.622$, $p < 0.001$ in model B, $\beta = 0.325$, $p < 0.001$ in model C). Its odds ratios are greater than one across the models in table 4b (model B: OR = 1.863, $p < 0.001$; model C: OR = 1.383, $p < 0.001$), which indicates that EMNEs are more likely than DMNEs to choose SAS-related greenfield FDI projects. Furthermore, the average marginal effect for model B in table 5 shows that the probability of choosing a greenfield R&D project is 0.027 higher ($p = 0.000$, $p < 0.001$), suggesting that the likelihood of an EMNE parent firm undertaking SAS greenfield investment increased by 2.7 per cent (at the 0.1 per cent significant level). Thus, hypothesis 1 is supported.

We also include an interaction term between PEIDiff and the EMNE dummy variable, which is significant and positive in model C (table 4a). The log odds ratio for the interaction term EMNE * PEIDiff (OR = 1.143, $p < 0.001$) in table 4b is larger than 1, which implies that the probability of EMNEs undertaking SAS greenfield FDI is higher when there is superior patent enforcement protection between an MNE's home and target countries. Importantly, the average marginal effects for model C in table 5 also show the probability of having a SAS orientation by EMNEs in high PEI difference countries is 1.1 per cent ($p = 0.000$, $p < 0.001$) higher. PEIDiff, therefore, positively moderates EMNEs' choices of greenfield R&D FDI (figure 1). Hypothesis 2 is thus supported.

Figure 1. Interaction between EMNE dummy and PEI difference variable



Source: Authors' estimations.

It is possible that geopolitical conditions differentially restricted EMNE M&As in more recent periods, forcing EMNEs into SAS activities through greenfield FDI. If this were the case, we could not attribute EMNEs' greater propensity for R&D-related greenfield FDI only to firm-level catch-up motives, as hypothesized. This is because there would be additional geopolitical factors in play that limit EMNEs' freedom of choice. As we cannot meaningfully control for such policy and geopolitical changes and their differential impacts on EMNEs versus DMNEs, we opted to run our model for an earlier-period sub-sample. Specifically, we performed logistic regression analyses for the years prior to 2017 and the rise of the Trump administration in the United States, which marked a significant inward turn in geopolitical relations regarding openness of international trade and investment relations.

Table 6a shows that the coefficient of the EMNE dummy variable was significant and positive ($\beta = 0.629$, $p < 0.001$ in model 2; $\beta = 0.395$, $p < 0.001$ in model 3). Its odds ratios are greater than 1 across the models in table 6b (model 2: OR = 1.876, $p < 0.001$; model 3: OR = 1.484, $p < 0.001$), which indicates that EMNEs are more likely than DMNEs to choose SAS-related greenfield FDI projects. Furthermore, the average marginal effect for EMNEs in table 7 shows that the probability of choosing SAS investment is 0.031 higher ($p < 0.001$), suggesting that the likelihood of an EMNE parent firm undertaking SAS greenfield investment increased by 3.1 per cent (at the 0.1 per cent significance level). Thus, hypothesis 1 is further supported.

We also include the interaction term (EMNE * PEIDiff), which is significant and positive in model 3 (table 6a). The log odds ratio is 1.12 ($p < 0.001$) (table 6b), which implies that the probability of EMNE investors undertaking SAS greenfield FDI increases when there is superior patent enforcement protection between an MNE's home and target countries. Importantly, the average marginal effects for this interaction term (table 7) also show that the probability of EMNEs in high PEI difference countries having a SAS orientation is 0.9 per cent ($p < 0.001$) higher. PEIDiff, therefore, positively moderates EMNEs' choices for greenfield R&D FDI. Hypothesis 2 is thus supported.[3]

[3] By way of additional robustness checks, we incorporated a number of additional control variables (including target PEI index) as well as similar base models but for different time periods. Our results remained consistent across a broad spectrum of different models. Results available from authors by request.

Table 6a. Logistic regression for SAS greenfield investments (coefficients), 2003–2016

R&D/DDT investment	Model A	Model B	Model C
HmPEI	-0.074* (0.031)	0.006 (0.033)	0.011 (0.033)
JobsCrt	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
InnoHost	0.037*** (0.007)	0.039*** (0.007)	0.039*** (0.007)
LawHost	0.013** (0.005)	0.013** (0.005)	0.013** (0.005)
GRHost	0.024*** (0.002)	0.024*** (0.002)	0.024*** (0.002)
BusEase	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)
CapInv	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
ValInt	-0.011** (0.004)	-0.011** (0.004)	-0.011** (0.004)
InstQ	-0.016+ (0.008)	-0.015+ (0.008)	-0.016* (0.008)
TradeSc	-0.087*** (0.007)	-0.088*** (0.007)	-0.088*** (0.007)
R&DExp	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
GlbCity	0.132** (0.039)	0.132** (0.039)	0.131** (0.039)
TechClus	-0.347*** (0.037)	-0.345*** (0.037)	-0.346*** (0.037)
CapCity	-0.384*** (0.043)	-0.384*** (0.043)	-0.380*** (0.043)
InstHost	0.518*** (0.127)	0.543*** (0.128)	0.537*** (0.127)
FrmExp	0.115*** (0.006)	0.116*** (0.006)	0.116*** (0.006)
LogGDP	0.604*** (0.046)	0.617*** (0.046)	0.612*** (0.047)
PEIDiff	-0.115*** (0.030)	-0.124*** (0.030)	-0.130*** (0.030)
EMNE		0.629*** (0.080)	0.395*** (0.092)
EMNE*PEIDiff			0.113*** (0.021)
Observations	76 353	76 353	76 353
_cons	-2.047*** (0.346)	-2.820*** (0.362)	-2.840*** (0.363)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Wald Chi-square	4 702.17	4 722.60	4 745.16
Log pseudolikelihood	-21 216.80	-21 186.89	-21 173.37
Akaike's information criterion	42 567.60	42 509.78	42 484.75
Pseudo R-square	0.138	0.139	0.140
Mean variance inflation factor	6.10	6.06	6.02

Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

Table 6b. Logistic regression for SS greenfield investments (odds ratio), 2003–2016

R&D/DDT investment	Model A	Model B	Model C
HmPEI	0.928* (0.029)	1.006 (0.033)	1.011 (0.033)
JobsCrt	1.000 (0.000)	1.000 (0.000)	1.000 (0.000)
InnoHost	1.038*** (0.008)	1.039*** (0.008)	1.040*** (0.008)
LawHost	1.013** (0.005)	1.013** (0.005)	1.013** (0.005)
GRHost	1.024*** (0.002)	1.024*** (0.002)	1.024*** (0.002)
BusEase	0.997 (0.004)	0.997 (0.004)	0.997 (0.004)
CapInv	0.998*** (0.000)	0.998*** (0.000)	0.998*** (0.000)
ValInt	0.989** (0.004)	0.989** (0.004)	0.989** (0.004)
InstQ	0.985^{+} (0.008)	0.985^{+} (0.008)	0.984* (0.008)
TradeSc	0.916*** (0.007)	0.916*** (0.007)	0.916*** (0.007)
R&DExp	1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)
GlbCity	1.141** (0.045)	1.141** (0.045)	1.140** (0.044)
TechClus	0.707*** (0.026)	0.708*** (0.026)	0.707*** (0.026)
CapCity	0.681*** (0.029)	0.681*** (0.029)	0.684*** (0.029)
InstHost	1.678*** (0.214)	1.721*** (0.220)	1.710*** (0.218)
FrmExp	1.122*** (0.006)	1.123*** (0.006)	1.123*** (0.006)
LogGDP	1.829*** (0.085)	1.853*** (0.086)	1.844*** (0.086)
PEIDiff	0.891*** (0.026)	0.884*** (0.026)	0.878*** (0.026)
EMNE		1.876*** (0.150)	1.484*** (0.137)
EMNE*PEIDiff			1.120*** (0.023)
Observations	0.129***	0.060***	0.058***
_cons	(0.045) 76 353	(0.022) 76 353	(0.021) 76 353
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Wald Chi-square	4 702.17	4 722.60	4 745.16
Log pseudolikelihood	-21 216.80	-21 186.89	-21 173.37
Akaike's information criterion	42 567.60	42 509.78	42 484.75
Pseudo R-square	0.138	0.139	0.140
Mean variance inflation factor	6.10	6.06	6.02

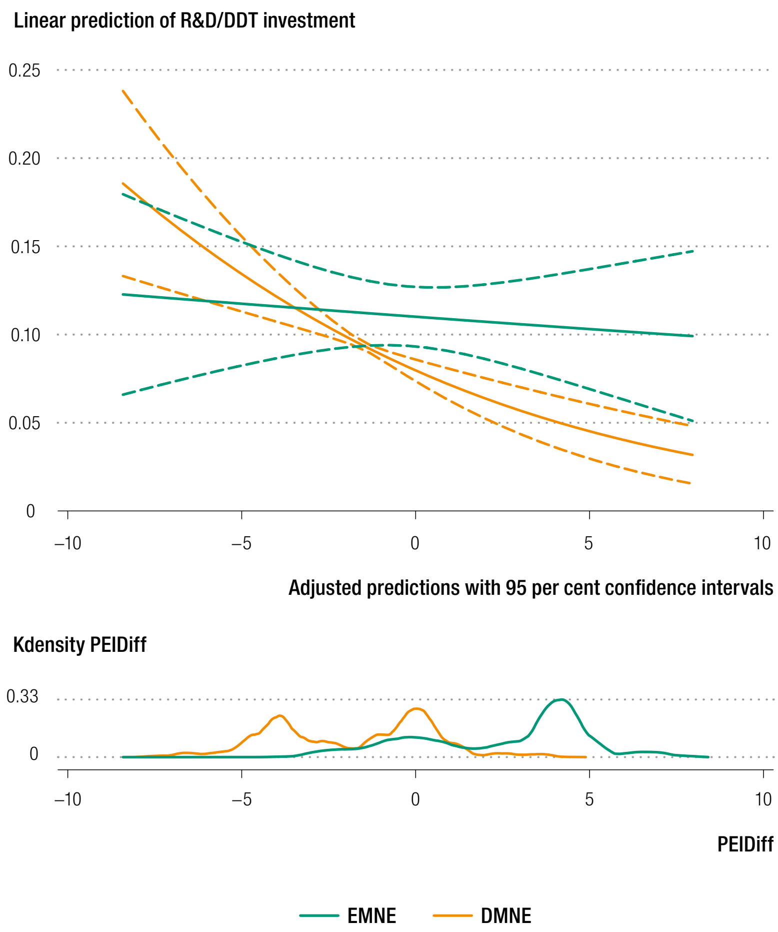
Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}$ $p < 0.1$.

Table 7. Average marginal effects, 2003–2016

Term	Hypothesis	SAS_dy/dx
EMNE	H1	0.031***(0.000)
EMNE* PEIDiff	H2	0.009***(0.000)

Source: Authors' estimations.
Note: Robust standard errors are in parentheses. *** $p < 0.001$.

Figure 2. Interaction between EMNE dummy and PEI difference variable, 2003–2016



Source: Authors' estimations.

5. Discussion

Our findings show (i) that EMNEs are more likely than DMNEs to undertake greenfield R&D FDI than other types of FDI projects; and (ii) that patent enforcement protection affects the innovation offshoring location choice more strongly for EMNEs than for DMNEs. We first discuss the implications of incorporating SAS greenfield FDI for the EMNE catch-up literature before considering implications for EMNE-related theory, including the springboard theory (Luo and Tung, 2018). This is followed by discussion of policy implications.

5.1 Greenfield capability-building/knowledge-seeking SAS-related FDI: EMNEs versus DMNEs

International business scholars have become interested in whether EMNEs are different than DMNEs and thus if novel theory is required to analyse EMNEs' outward FDI. The increased tendency towards SAS has been strongly highlighted in EMNE theorizing in this regard (Hernandez and Guillén, 2018; Kumar et al., 2020; Liu and Giroud, 2016; Luo and Tung, 2018). The international business literature on firm-level catch-up through SAS, however, has mainly considered international M&As. SAS-related greenfield FDI has been overlooked (Schaefer, 2020; Schaefer and Liefner, 2017). This may be because perspectives such as the springboard theory, which emphasizes catch-up speed and thus acquisitions as the preferred establishment mode for SAS, have been highly influential in this debate (Luo and Tung, 2018).[4] As Luo and Tung (2018, p. 147) candidly acknowledge, "most research has looked at SMNEs [springboard MNEs] through the lens of M&As, while little attention has been paid to other important investment modes".

SAS-related greenfield FDI has arguably become a far more important approach to firm-level technological catch-up taken by EMNEs. Indeed, during the 2003–2021 period, 16,753 greenfield R&D foreign investments were made in total; of these, 1,596 (9.5 per cent) originated from 741 EMNE parent firms.[5] However, over the period in question the EMNE share of greenfield R&D-related FDI increased from 3.5 per cent of total annual capital investment in 2006 to a high of 17.3 per cent in 2017. In the same period, annual employee share rose from 5.2 per cent to 16.2 per cent and number of total investments from 5.5 per cent to 13 per cent (fDi Markets database). EMNEs, therefore, have become much more important contributors to

[4] The word "acquisition(s)" is mentioned 31 times, "rapid" 7 times, "accelerate(d)" 6 times, and "speed" and "fast(er)" 5 times each. By contrast, "greenfield" is mentioned only 1 time, on the penultimate page in the "future research and suggested agenda" section (Luo and Tung, 2018, p. 147).

[5] Each parent had on average 2.15 subsidiaries, US$100 million of total investment and 257 employees (fDi Markets project database).

international R&D innovation offshoring. These large EMNEs have created complex international innovation networks with hundreds of foreign R&D subsidiaries, tapping into key location-bounded assets around the world, often benefitting from excellent institutional environments. Case study evidence, moreover, showed that many of these EMNEs had successfully engaged in overseas innovation activities that facilitated capability-building and firm-level catch-up. For example: Tata (Becker-Ritterspach and Bruche, 2012), Infosys (Kimble, 2013), Naspers (Teer-Tomaselli et al., 2019), Mahindra (Ramaswamy and Chopra, 2014), and Huawei (Schaefer, 2020).[6]

Owing to the changing geopolitical environment and a push towards international decoupling, leading to greater scrutiny of some M&A deals, greenfield SAS strategies have now become more realistic options for some EMNEs. In the United States, for example, the Committee for Foreign Investment in the United States (CFIUS) heavily scrutinizes deals from strategic rivals (such as China and the Russian Federation) (Godsell et al., 2023). In the European Union, moreover, there is now increasing awareness of the need for greater cross-market regulation, with significant review of individual national policies taking place (European Commission, 2022).[7] However, it is important to note that our results suggest that it is not only increased regulation that drives the greater proclivity towards greenfield R&D FDI projects. Decomposing our sample to a time period before 2017 when the geopolitical environment was not as hostile (2003–2016), we also find that EMNEs had a stronger preference for greenfield SAS-related projects.

The idea that accelerated internationalization is embodied by aggressive acquisitions, as characterized by Luo and Tung's (2018) springboard theory, tells only part of the story about EMNE catch-up strategies. And though the associated literature has emphasized the explosive, aggressive and rapid nature of springboard FDI activity, a rebalancing towards a greater emphasis on greenfield FDI may lead to a more realistic evaluation of EMNEs' internationalization trajectories. Building up

[6] After Huawei Technologies (China), which is the largest outward FDI investor in R&D by some distance (it has invested US$7.9 billion, employing 22,335 people in 142 foreign R&D subsidiaries), some of the other largest EMNE investors in greenfield R&D include Infosys Technologies (India, software and information technology (IT) services, US$3.2 billion in greenfield R&D FDI, 10,875 overseas R&D employees, 31 R&D subsidiaries); Tata Group (India, diversified, US$3.1 billion, 8,516 employees, 52 subsidiaries); Mahindra Group (US$1.9 billion, 5,539 employees, 55 R&D subsidiaries); Mercado Libre (Argentina, e-commerce, US$1.2 billion, 351 employees, 8 subsidiaries); Softtek (Mexico, software and IT services, US$1.1 billion, 610 employees, 6 subsidiaries); Naspers (South Africa, technology, media and internet, US$768 million, 1,027 employees, 11 subsidiaries); Tune Group (Malaysia, leisure and entertainment, US$592 million, 331 employees, 3 subsidiaries); Comcraft Group (Kenya, diversified, US$430 million, 2,947 employees, 7 subsidiaries); Stefanini IT Solutions (Brazil, IT, US$390 million, 264 employees, 4 subsidiaries); Neuberg Diagnostics (health care, US$415 million, 52 employees, 6 subsidiaries).

[7] The acquisition of high-tech German robotics maker Kuka by Midea (China) in 2016 marked a watershed moment in Europe, leading to considerable debate about greater control of technology-seeking M&As, particularly of those from China.

R&D capabilities through greenfield FDI can take time, but as shown by some of the most successful EMNEs (in terms of innovation capabilities, i.e. Huawei, Infosys, Tata, Mahindra, Comcraft, Mercado Libre), it can be a highly effective approach. Case study evidence increasingly demonstrates that EMNEs invest heavily in their overseas R&D subsidiaries and draw strongly from them in their push to catch up with the most innovative DMNEs (Schaefer, 2020). Larger-scale empirical studies also show that EMNEs significantly benefit from offshore innovation in advanced institutional environments (Bruno et al., 2021; Rosenbusch et al., 2019). This points towards a future in which EMNEs extend their innovation capabilities beyond those related to composition and bricolage aimed at the "middle of the pyramid" (Amin, 2023; Brandt and Thun, 2016) towards one in which they compete at the very leading edge of technological development in high-income markets.

5.2 Institutional arbitrage: EMNEs versus DMNEs

At a conceptual level, the international business debate focuses on whether mainstream theory is applicable and useful for understanding EMNEs. In this regard, institutional arbitrage-related FDI has been frequently highlighted as a salient characteristic of EMNEs (Boisot and Meyer, 2008; Golikova et al., 2014). Again, however, to our knowledge there have been only a few attempts to empirically explore (using relatively large data sets and going beyond case studies) whether this is true or not (Bruno et al., 2021; Rosenbusch et al., 2019). If true, for what types of institutions and in what types of investment scenarios does theory suggest that institutional arbitrage by EMNEs might act as a driver for outward FDI, differentiating EMNEs from DMNEs?

Springboard theory is rather vague regarding the types of institutional arbitrage EMNEs seek to benefit from. According to Luo and Tung (2018, p. 130), "International springboard is a global strategy to improve a firm's global competitiveness and catch up with established and powerful rivals in a relatively rapid fashion through aggressive strategic asset- and opportunity-seeking, *and by benefitting from favorable institutions in foreign countries*" [emphasis added]. Springboard theory also talks of reducing "vulnerability to home institutions" and undertaking FDI to "alleviate institutional and market constraints at home" (Luo and Tung, 2018, p. 131). Springboard theory does not explore in any detail the specific institutional needs of EMNEs and, importantly, how or whether these differ from those of DMNEs (Hertenstein and Alon, 2022).

We hypothesized that the role of IPR-related institutions would likely become of crucial importance when knowledge-seeking (i.e. R&D-focused activity) motivates the greenfield FDI. We then argued that EMNEs, which invest heavily in offshore R&D centres to "impel" capability upgrading (He et al., 2018, p.248), necessarily require strong IPR enforcement. Environments with strong IPR enforcement are found mainly in developed markets, where DMNEs originate (and typically already have R&D subsidiaries). As such, it may not be hard to understand why IPR institutional quality is a weaker driver of R&D innovation-related investment for DMNEs. DMNEs, unlike EMNEs, already have sufficient exposure to sound IPR environments. They are not compelled, moreover, to invest as large a share of their resource base in their R&D activities, owing to their technological leadership positions (i.e. they do not have to engage in firm-level catch-up). By contrast, EMNEs that are looking to catch up must invest comparatively heavily in such subsidiaries. This may explain why stronger IPR protection more strongly drives their choice of FDI.[8]

Is this surprising? Interestingly, a growing body of empirical evidence supports positive innovation performance outcomes for EMNEs relative to DMNEs when entering markets with better institutions. This may also help explain our results concerning FDI preferences or the rationale for why EMNEs are attracted by better patent enforcement regimes. Bruno et al. (2021), for example, recently showed that EMNEs had better innovation performance than DMNEs when their R&D subsidiaries were located in jurisdictions with strong IPR protection. Rosenbusch et al. (2019) conducted a comprehensive meta-analysis (based on 48 samples taken from existing studies) of the impacts of innovation offshoring. They too found a positive significant relationship that was “contingent upon the home institutional environment”: when home institutions were weak it facilitated “institutional arbitrage outcomes” (Rosenbusch et al., 2019, p. 203). Why do we see such outcomes? One possibility is, as we have suggested, that EMNEs commit strongly to their overseas R&D subsidiaries to impel the upgrading of their own capability and technology.

[8] This is reflected in aggregate greenfield R&D FDI. Although EMNEs in the sample have invested in R&D subsidiaries in at least 107 developing- and developed-target countries, the top 10 developed markets with high PEI enforcement (including Canada, Germany, Hong Kong (China), Italy, Japan, Singapore, Sweden, the United Kingdom and the United States) attracted about 42 per cent of all R&D FDI by EMNEs (and provided 33 per cent of employees). The United States was the single most popular destination for EMNEs, receiving 14 per cent of total FDI and 16 per cent of employees.

By contrast, in the same period (2003 to 2021), the two most attractive destinations for DMNEs’ greenfield R&D subsidiaries were India and China, together accounting for 32 per cent of total capital invested and 46 per cent of all R&D employees that DMNEs hired globally. Developed markets were nonetheless still important for DMNEs when doing R&D-related FDI, albeit not nearly as important as they were for EMNEs. Thus, for DMNEs, all developed markets combined attracted 46 per cent of their FDI capital and 32 per cent of jobs. For EMNES these figures stood at 52 per cent and 42 per cent respectively. Despite large geographic and high physical distances, encompassing additional “liabilities of foreignness”, EMNEs were keen to exploit developed-market environments for the purposes of R&D-related FDI.

5.3 Policy implications

For developed-market economies, the rise of EMNEs through aggressive cross-border M&As has raised considerable concerns regarding whether there is a level playing field. MNEs from China, for example, have been accused of playing by a different rulebook, relying upon a relatively protected domestic market and State-supported selective industrial policies to support its MNEs in acquiring high-tech developed-market businesses as part of a sophisticated techno-nationalist industrial strategy (i.e. Chemchina's acquisition of Syngenta or Midea's acquisition of Kuka). The CFIUS, for example, has become active in blocking M&As, particularly in strategically important industries. In the European Union, as in the United States, sentiment among policymakers has recently started to swing more towards regulation of inward M&As – although the picture is more complex owing to the many different interests of member States and different national screening regimes (European Commission, 2022). What is important to note here is that to date policy debate has focused overwhelmingly on M&As. Greenfield R&D-related FDI from EMNEs appears to have been largely overlooked.

This is likely for several reasons. First, greenfield R&D FDI may involve reinvestment from existing foreign subsidiaries, either from previously acquired subsidiaries of EMNEs or greenfield FDI projects. The former approach is common (He et al., 2018). These investments may qualify as FDI only if one uses an "ultimate owner" definition of FDI, but many domestic reinvestments are hard to monitor and may simply be overlooked. Such FDI may be on a far more modest scale, at least initially, and thus harder to identify than most typical M&A deals. Commercial data collection agencies (i.e. fDi Markets) may not even collect information on smaller greenfield investments. Second, as greenfield FDI does not have the potential to destroy jobs (unlike M&As, where post-acquisition layoffs may occur), it receives less political attention. Rather, such FDI is politically beneficial to host regions, as it creates high-paying job opportunities. Third, greenfield FDI does not, in the first instance, generally involve taking possession of any strategic assets. There is, therefore, nothing to initially screen or block (say on national security grounds), unlike in the case of M&As. These factors make greenfield R&D-related FDI difficult to regulate for developed-market economies, but at the same a useful strategic option for EMNEs to adopt (and their governments to support). Thus, developed-market policymakers are encouraged to develop greater awareness of the potential threat to domestic technological leakage from greenfield R&D-related FDI by EMNEs. Greater restrictions on one form of establishment mode (i.e. M&As) necessarily requires greater consideration of alternatives (i.e. greenfield FDI) if original policy goals are to be achieved (namely restriction of knowledge acquisition by EMNE competitors in key strategic industries).

Conversely, there may still be opportunities for home and host countries to find common ground on the perceived benefits of greenfield FDI flowing from emerging markets to developed markets. As mentioned earlier, the promise of creating high-paying jobs and all the related benefits (such as stimulation of local economic activity and the start-up of complementary business by local entrepreneurs) are highly desirable outcomes for the host market. Promoting meaningful engagement in greenfield R&D FDI could be a political win for both home and host country governments in some instances – particularly those where the developed host market has limited interest in developing its own industries and in "decoupling" from or becoming less dependent on emerging markets. A potential actionable avenue is the creation of investment promotion agencies with a focus on greenfield investment from EMNEs.

From the EMNE perspective, the evolution of SAS towards greenfield investment appears logical, given the increasing constraints on other forms of FDI. EMNEs such as Huawei, Tata, Infosys and others have shown that these strategies can be tremendously effective. They avoid the political fallout associated with high-profile M&As. They also circumvent the added restrictions such deals are increasingly facing. Neither do greenfield approaches face the same types of integration challenges, which for large international M&As require high levels of absorptive capacity and the capability to deal with large cultural differences (sometimes exacerbated by State ownership of the acquirer).

The policy challenge for developing countries will be to facilitate continued investment by their MNEs in greenfield R&D without exacerbating current geopolitical tensions during an era of growing techno-nationalist frictions. Missteps could lead to further restrictions on greenfield R&D-related FDI, although developed-market governments face the aforementioned regulatory challenges. A growing body of empirical evidence suggests EMNEs can and do benefit from greenfield R&D-related FDI and, more generally, are creative in their approaches to innovation and catching up (Yamin, 2023). This suggests policymakers in emerging markets should think carefully about how such outward FDI can be encouraged and linked with existing initiatives. Emerging-market policymakers will need to balance and manage their relationships with developed economies, given the greater wariness of developed-market governments towards the approaches that some EMNEs have used to seek knowledge through FDI.

6. Conclusions

EMNE-related research analysing SAS types of capability-building FDI has for the most part looked at cross-border M&As. An assumption in mainstream international business theorizing (i.e. springboard theory) is that it is only through M&As that sufficient high-quality strategic assets can be acquired to facilitate accelerated catch-up (Kumar et al., 2020; Luo and Tung, 2018). Yet one outcome of this M&A focus has been the neglect of research on greenfield FDI as a strategic firm-level catch-up response by EMNEs. We have argued that EMNEs have a greater proclivity to create greenfield R&D subsidiaries over other types of foreign subsidiaries when compared with DMNEs. Although such FDI may not appear, at face value, to create opportunities for rapid and accelerated catch-up, it has arguably become a very successful approach for many EMNEs (e.g. Huawei, Infosys, Mahindra, Tata, Comcraft, Mercado Libre and Softtek). In the face of greater geopolitical pressures and international decoupling, moreover, it is becoming a more realistic option for many EMNEs.

At a conceptual level, springboard theory and associated EMNE theorizing has been relatively silent on the exact types of institutional arbitrage that EMNEs may engage in and how they vary between EMNEs and DMNEs. We show that home- or host-country superiority in IPR enforcement is a stronger driver for EMNEs when deciding to undertake greenfield R&D-related FDI in innovation offshoring. This, we argue, is because EMNEs make significant commitments to their offshore R&D hubs, which they look to develop and use as their key centres for innovation and firm-level catch-up. They do this so as to catalyse firm-level catch-up with DMNEs. EMNEs, moreover, are typically underexposed to high-quality IPR enforcement regimes, which they lack at home. Combined, this makes EMNEs more attracted towards this type of IPR-related institutional arbitrage when undertaking innovation offshoring.

From a policy perspective, better understanding of greenfield knowledge-seeking FDI is becoming of ever greater importance. This is because EMNEs face higher political hurdles in undertaking cross-border M&As during an era in which techno-nationalist industrial policies are on the rise. Greenfield FDI presents far fewer regulatory challenges for EMNEs. For policymakers from emerging economies, therefore, promoting an environment favourable to outbound greenfield FDI, particularly to countries with strong IPR protection, may be advisable and may enhance their innovation capacity in the longer term. By contrast, for policymakers in developed countries that are looking to adopt techno-nationalist strategies that domestically promote some of the key industries of the future (e.g. electric vehicles, renewables, artificial intelligence and so on), greater consideration of how to regulate knowledge-seeking EMNE greenfield FDI may be required. For these advanced economies, loss of key IPR may be a concern. A greater EMNE presence brings with it more competition for key knowledge resources, which may undermine their own industrial policies.

We still do not know enough about how EMNEs can exploit greenfield R&D-related FDI, or what the specific outcomes of such investments are in both the host and home countries. More detailed case study analysis is required of how EMNEs develop foreign R&D subsidiaries (e.g. strategies for attracting the best talent and retaining it, how they cooperate with foreign universities and other research centres or hubs) and subsequently transfer knowledge from greenfield subsidiaries in foreign markets to their home base (Schaeffer, 2020). Future research may also explore the way in which EMNEs look to exploit superior IPR environments in foreign markets and why they do so. Institutional arbitrage in EMNEs remains a relatively under-researched area in the field of international business. Our research suggests that it is important. Future research could also explore what other types of institutions attract EMNEs. Incorporating additional analysis of IPR protection is one potentially fruitful avenue for further research, again, possibly at the firm level by exploring specific cases and/or industries in greater depth. Such analysis will contribute to a better understanding of springboard theory and the associated literature on firm-level catch-up of EMNEs.

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