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Abstract

This paper investigates how the presence of foreign direct investment (FDI) contributes to domestic innovation with a focus on green technologies in the European regions between 2013 and 2018. Using a rich dataset combining patent data, firm-level data and FDI proxies, we identify a clear pattern: when foreign investors are technologically sophisticated, domestic firms in the regions where they invested show a higher propensity for patenting. The patenting activity by the parent companies of multinational enterprises (MNEs) and their corporate perimeter plays a more crucial role than local foreign subsidiaries. Furthermore, we find that the technological focus of MNEs – green vs. non-green – shapes the direction of these spill-overs. Notably, we provide novel evidence of linkages between the green patenting activity of MNE parents located abroad and the green innovation of domestic firms in the European Union, mediated through foreign subsidiaries operating in close proximity. Policy efforts aiming to foster green innovation should therefore prioritise attracting foreign investors with strong innovation records in environmentally sustainable technologies.

Keywords: technological spill-overs, multinational enterprises, FDI, domestic innovation, firm-level data

JEL classification: O32; F23; O34; L23

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1. Introduction

Foreign direct investment (FDI) is a pivotal driver of economic growth worldwide, facilitating the transfer of critical knowledge and technology from origin to host countries. However, not every FDI necessarily results in technological spill-overs, as the likelihood of such spill-overs depends on both the innovative capacity of the investing firms and the absorptive capacity of domestic firms. In this paper, our prior is that, given a certain level of absorptive capacity, technological spill-overs are more likely to foster innovative outcomes in a host region when FDI originates from highly innovative firms. While the literature extensively examines the spill-over effects of FDI on domestic firms and regions, it lacks studies that explicitly link innovative FDI to technological outcomes. This paper aims to fill this gap by investigating the case of the European Union (EU) in the 2013-2018 period.

Identifying the causality of technological spill-overs by multinational activities on domestic firms and regions obviously presents a significant challenge. A positive association between the activity of a multinational enterprise (MNE) and the innovation outcomes of domestic firms can be the result of a reverse causality, as highly innovative investors can be attracted to regions where there are already firms with a higher level of innovation activity. At the same time, firm-level patenting might be a poor proxy for firms' innovation dynamics, as we know patents can confound innovation abilities and the protection of intellectual property rights (IPRs).

For our scope, we propose to separate the empirical investigation into two parts. In the first part, we focus on regional industries in the EU. In the second part, we transition to a fully fledged firm-level analysis. In particular, in the first stage, we adopt the two-digit code of the Nomenclature of Territorial Units for Statistics (NUTS) and the two-digit code of the Statistical Classification of Economic Activities (NACE Rev. 2). Our analysis employs two types of FDI measures for each regional sector, encompassing a total of eight proxies that cover different aspects of investment dynamics. By using firm-level data of MNEs, we reconstruct traditional financial FDI metrics. We compute the total assets of foreign-owned firms, the value and number of greenfield investment projects, and the value and number of mergers and acquisition (M&A) deals. A second type of metric reconstructs from firm-level data the technological content of FDI, including: the number of patents owned by the foreign-owned local subsidiaries, the number of patents owned by the parent company in a specific regional sector, and the total number of patents owned by all the other members of the MNE's corporate group, excluding the local subsidiaries. Importantly, we include a comprehensive set of control variables to account for year-industry-specific shocks and a battery of industry- and time-fixed effects to mitigate the influence of unobserved shocks, thereby mitigating endogeneity concerns.

Our findings highlight strong and positive associations between FDI proxies and innovation metrics, thus underscoring FDI's potential to stimulate innovation in regional industries. Particularly significant and positive is the coefficient of patents owned by the parent as well as that of patents owned by the entire corporate group in relationship to the patenting activity of domestic regional industries.

Against the previous background, our intuition is that innovation activities performed in any corner of the corporate perimeter of an MNE make the entire MNE more innovative. It therefore makes sense that, even if they do not hold any patents, subsidiaries located in a host country can benefit from the patenting activity of the rest of the MNE. Consequently, in the host regional industry, domestic firms may have the chance to appropriate at least a portion of the technology that the investing MNE has generated regardless of the patenting activity of the local foreign subsidiaries.

Following the overall sectoral-regional analysis, we extend our investigation to explore the case of so-called 'green' innovation. Using the OECD classification by Haščič and Migotto (2015), we restrict our analysis to the publication of green patents. To control for scale effects within a regional sector, we include the number of non-green patents published by domestic firms in the same regional sector. The results suggest that, in the case of green innovation, only the patenting activities within the MNE group of foreign-owned local subsidiaries are relevant. This may indicate a degree of universality of green technologies, which can spill over beyond geographical borders via foreign-owned subsidiaries operating in distant locations. To further investigate whether technological trajectories within the parent's ownership group of foreign-owned subsidiaries influence local innovation by domestic firms, we distinguish between green and non-green innovation by the groups and the parent of these subsidiaries. Our analysis reveals the presence of a technological trajectory within the groups: when the group of foreign-owned local subsidiaries specialises in green innovation, this type of innovation spills over into the local market. Conversely, if the group focuses on non-green innovation, the production of green innovation in the local market declines.

In the second part of our paper, we transition from the regional-sector to a firm-level investigation, aiming to capture more granular insights into the relationship between FDI and innovation. We examine the indirect impact of innovation owned directly or indirectly by foreign-owned local subsidiaries on the innovation outputs of individual domestic firms within a regional sector. By leveraging firm-level data, we can control for heterogeneity in firms' characteristics.

The results are in line with our first aggregate exercise. The innovation by the foreign local subsidiaries does not appear to play a significant role in fostering domestic firms' innovation. In contrast, the innovation generated by the MNE group or by the MNE parent is positively associated.

The remainder of this paper is organised as follows: Section 2 reviews the relevant literature, while Sections 3 and 4 present the data sources and preliminary evidence, respectively. Sections 5 and 6 discuss the model and results of the regional analysis, while Sections 7 and 8 present the firm-level analysis. Finally, section 9 provides a summary and concluding remarks.

2. Literature Review

FDI has become a key driver of economic growth in both developed and developing economies. A substantial body of literature has demonstrated that FDI facilitates the transfer of valuable know-how and technology from MNEs to host countries, thereby enhancing their economic potential (Aitken and Harrison 1999; Hermes and Lensink 2003; Beugelsdijk et al. 2008; Paul and Feliciano-Cestero 2021; Fang et al. 2023; Keller and Yeaple 2009). This transfer not only enhances productivity but also catalyses innovation within host countries, primarily through two types of knowledge spill-overs: direct and indirect. Direct spill-overs occur when MNEs transfer knowledge and expertise to their local affiliates or suppliers, while indirect spill-overs arise from the stimulated vertical and horizontal demand or supply by MNEs for domestic enterprises (Javorcik 2004; Rojec and Knell 2017; Di Ubaldo and Siedschlag 2022; Nguyen et al. 2024), alongside enhancements in market structures (Barrios et al. 2005). Various theoretical frameworks, such as Marshall-Arrow-Romer (MAR) spill-overs (Marshall 1980; Arrow 1962; Romer 1986) and Porter's (1990) competitive spill-overs, further explain how proximity to foreign firms can facilitate the diffusion of knowledge among local businesses (Yue and Huang 2024; Martins 2011).

The literature has also produced various theoretical models to identify the drivers of FDI (Blomström 2003; Alfaro et al. 2004; Blonigen 2005; Villaverde and Maza 2012; Head and Mayer 2014; Blonigen and Piger 2014), with several studies highlighting as key determinants market size (Kleinert and Toubal 2011; Head and Ries 2005), regulatory environment and institutional quality (Jensen 2008; Egger et al. 2019; Bénassy-Quéré et al. 2007), and infrastructure (Cheng and Kwan 2000; Sabir et al. 2019). Additionally, the presence of trade barriers and traditional gravity determinants (Goh and Tham 2013), along with the availability of skilled and educated labour, significantly influence FDI inflows, especially in developing countries (Becker et al. 2020).

Innovation intensity in advanced economies shares many of these drivers. Indeed, innovation is often tightly integrated within specific territories, influenced by social and institutional contexts (Rodrìguex-Pose and Crescenzi 2008). Furman et al. (2002) identify four key drivers of innovation: the availability of highly skilled labour, competitive environments that reward innovation, strong local demand for advanced goods, and the interconnectedness of related industries. All these factors are shaped by both regulatory policies and openness to international trade (Sakakibara and Porter 2000).

Therefore, a major challenge in analysing the impact of FDI on domestic firms' innovation is the endogeneity of FDI decisions. The correlation between FDI inflows and economic development can lead to biased results, as the decision to invest may be influenced by the productivity of domestic firms (Keller 2021). To address this issue, some studies introduce industry- and time-fixed effects to control for unobserved heterogeneity. However, residual endogeneity may persist if other specific shocks, such as energy price changes or technological innovations, are not accounted for (Blalock and Gertler 2008). Alternative measures of innovation, such as the number of patents rather than productivity, have been employed to mitigate endogeneity concerns. Given that FDI spill-overs enhance the knowledge base of firms, this can increase the likelihood of new innovations in processes or products (Bloom et al. 2013; Hovhannisyan and Keller 2015).

In an attempt to combine these approaches, our study uses the number of patents as outcome variables and controls not only for industry- and time-fixed effects, but also for some additional controls mitigating the influence of other industry-year-specific shocks. By doing so, we aim to contribute to the ongoing and often conflicting debate on the relationship between FDI and local innovation. The existing literature provides mixed evidence; while some studies highlight a positive effect of inward FDI, driven by knowledge spill-overs (Branstetter 2006; Cheung and Lin 2003;), others emphasise negative effects linked to Schumpeterian dynamics and heightened competitive pressure (García et al. 2013; Chang et al. 2013; Chen 2007). More recent contributions attempt to reconcile these findings by exploring heterogeneity in the types of FDI or the characteristics of host regions. These studies suggest that certain forms of FDI are more beneficial to local economies (Ascani et al. 2020; Goel 2023; Tan et al. 2023), or that the effects depend on the absorptive capacity of the local environment (Rao et al. 2024; Fu 2008; Khachoo et al. 2018; Ning et al. 2016).

An even more critical area of contemporary research is ‘green’ innovation, which pertains to the development of environmentally sustainable technologies. As the urgency to address pressing environmental challenges (e.g. climate change and resource depletion) intensifies, green innovation has emerged as a central focus of scholarly inquiry. This type of innovation is vital for ensuring long-term economic resilience and is closely aligned with global sustainability objectives, including the Paris Agreement and the United Nations’ Sustainable Development Goals (SDGs). As such, understanding the mechanisms through which FDI influences green innovation carries significant policy implications, offering valuable insights into how investment strategies and regulatory frameworks can be designed to support and advance sustainability goals.

Several studies have demonstrated that FDI can facilitate the transfer of advanced technologies that promote environmental sustainability. For example, foreign acquisitions have been shown to reduce energy intensity, as foreign MNEs often introduce cleaner technologies compared to local firms (Brucal et al. 2019). In addition to technology transfer, foreign ownership also improves the financial conditions of local firms, enabling them to invest in sustainable practices (Wang 2015). The Porter (1990) hypothesis further suggests that stricter environmental regulations can spur innovation by motivating firms to develop green technologies (Acemoğlu et al. 2012). In this context, MNEs may be incentivised to invest in green technologies not only to comply with local regulations but also to enhance their corporate social responsibility (CSR) profiles. Empirical evidence further suggests that FDI can improve environmental performance, as foreign investors often bring higher environmental standards than domestic firms. In industries where environmental sustainability is a competitive advantage (e.g. renewable energy or clean technologies), foreign investments can significantly influence green innovation patterns (Goldbach 2019).

However, the analysis of green innovation poses its own empirical challenges. The technological trajectory of the acquiring firm plays a crucial role in determining whether green innovations are adopted. Koch and Smolka (2019) highlight how foreign-acquired firms often undergo restructuring, which may involve the adoption of greener technologies. However, this process is contingent upon the technological capabilities and market conditions of the acquiring firm. If the foreign investor specialises in non-green technologies, the host country may not experience significant green innovation, as the investor may prioritise existing non-green technologies for profitability, in line with the model proposed by Acemoğlu et al. (2012). Conversely, if the host country has a strong regulatory framework and offers incentives for green technologies, it may compel foreign firms to adopt its practices (Lai and Yan 2013).

Additionally, competition dynamics play a significant role in shaping the adoption of green technologies. Firms focused on non-green technologies may face competitive pressures that discourage the adoption of environmentally sustainable practices. Kretschmer et al. (2012) suggest that firms often concentrate their innovation efforts on specific technologies, excluding environmentally friendly options if their focus is on enhancing existing non-green products. This concentration can limit the diffusion of green technologies, particularly in industries dominated by non-green practices.

Given the growing importance of green innovation, our analysis adopts a dual approach to examining the relationship between FDI and innovation. First, we investigate the broader relationship between FDI and innovation by analysing total patent counts and, second, we specifically focus on green innovation, as measured by green patents. In the first phase, we assess the general impact of FDI on innovation by utilising total patent counts, which capture technological advancements across a wide range of sectors. In the second phase, we narrow our focus to green innovation, identifying green patents using the classification system developed by Haščič and Migotto (2015), updated to reflect the evolving cooperative patent classification (CPC). Non-green patents are incorporated as a control variable to account for the broader dynamics of innovation. This dual approach enables a comprehensive understanding of both the general and environmentally specific impacts of FDI on innovation.

3. Data

We compile a comprehensive dataset encompassing firm-level information, patent data, regional and sectoral variables, trade policy measures, and FDI measures across all NACE two-digit sectors and NUTS 2 regions of the European Union (EU27) from 2013 to 2018. A key innovation of this work lies in the construction of original proxies for FDI flows and stocks, as no comprehensive regional-sectoral panel currently exists for the EU. We build these proxies using firm-level data from Orbis and compare them against established international sources to ensure their credibility and representativeness. This step is essential for ensuring that our measures accurately capture cross-country, cross-sector and intertemporal variation in FDI.

Our dataset includes proxies for both FDI stocks and FDI flows. For FDI stocks, we use the total assets of foreign-owned subsidiaries at the year and regional-sector level, sourced from Orbis. We compare its year and country-sector level distribution to the OECD's measure of inward FDI stocks. While the absolute levels differ – as our proxy reflects book values of corporate assets, whereas the OECD captures equity stakes at market value – the underlying distributional patterns are strongly aligned. Specifically, we find a correlation of 0.93 when comparing country-industry-year distributions over the 2013-2018 period using NACE Rev. 2 sectors. This high correlation suggests that, despite the definitional differences and the lack of direct comparability in absolute terms, our measure captures the relevant cross-country and intertemporal variation in FDI. Since no official data exist at the regional-sector-year level (i.e. our unit of analysis), this result supports the validity of our proxy at more granular spatial and sectoral scales.

For FDI flows, we draw on M&A activity and greenfield investment data from the Orbis Crossborder Investments database. We compare M&A figures against data from the Institute for Mergers, Acquisitions and Alliances (IMAA), which is based on data compiled by Thomson Reuters. At the country-year level, we find a correlation of 0.72 for the number of transactions and 0.75 for their value. This confirms that the Orbis proxy captures meaningful cross-country variation in M&A activity while also offering greater granularity across regions and sectors.

For greenfield investments, we compare Orbis data with the widely used fDi Markets database compiled by the Financial Times. We find a correlation of 0.79 in the reported number of greenfield investments across the two sources and a correlation of 0.68 in their value at the country-year level.

Unfortunately, no official statistics are available on M&A activities and greenfield investments[1] at the country level. However, the strong alignment between Orbis and some widely used benchmark international sources at the country-year level provides confidence in the validity of our proxies.

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[1] Please note that Thomson Reuters data for M&A activities and the fDi Markets data of the Financial Times for greenfield investments are widely recognised as authoritative sources, including by institutional users. See, among others, Boeckelmann et al. (2024), Carril-Caccia and Pavlova (2018), and Canton and Solera (2016).

Beyond their role in measuring FDI, the firm-level data from Orbis provide rich financial information, which we use to construct controls for firm-level and regional-year-industry-level heterogeneity in economic activity. The database also offers detailed insights into ownership structures and corporate governance. These latter features were particularly valuable for identifying foreign-owned firms within specific regions and sectors as well as their global ultimate owners (hereafter referred to as ‘parents’) and the composition of their corporate group.

Patent data are obtained from the Orbis Intellectual Property database compiled by Moody’s, which facilitates the linkage of patents to their respective firm owners. These data represent our main outcome of interest and, coupled with ownership data, also serve to construct innovation-based measures of FDI.

To complement this information, we enrich our dataset with regional and sectoral statistics from Eurostat, aiming to account for observed heterogeneity across industries, regions and time. Additionally, we incorporate trade policy indicators to control for external market conditions and regulatory environments. Data on the stock number of technical barriers to trade (TBTs) and sanitary and phytosanitary (SPS) measures were accessed via the Integrated Trade Intelligence Portal (I-TIP) of the World Trade Organization (WTO) and refined using the methodology outlined in Ghodsi et al. (2017). Tariff information was sourced from the World Bank’s World Integrated Trade Solution (WITS), prioritising effectively applied tariff rates. In their absence, preferential rates were utilised, and if those were unavailable, unilateral most favoured nation (MFN) tariffs were applied. To assess trade barriers in services, we utilised the Services Trade Restrictiveness Index (STRI) compiled by the OECD.

Finally, we adopted Haščič and Migotto’s (2015) classification of green innovation, which identifies environmental technologies using the International Patent Classification (IPC) and CPC codes, to distinguish between green and non-green innovation. Their framework categorises green technology into six main types: 1) environmental management; 2) water-related adaptation; 3) climate change mitigation technologies for energy generation, transmission and distribution (CPC class Y02E); 4) capture, storage and disposal of greenhouse gases (CPC class Y02C); 5) climate change mitigation technologies in transportation (CPC class Y02T); and 6) climate change mitigation technologies in buildings (CPC class Y02B). For CPC sectors starting with the letter ‘Y’ that are not classified under the IPC, IPC codes were converted to CPC codes. Using conversion tables, we consistently tracked green patents across all CPC revisions during the study period. Patents citing these technologies form the sample of green innovations.

Patents citing other technologies enable us to identify non-green innovations. Specifically, if a patent does not cite any environmental technology class, it is classified as a non-green innovation. However, we refrain from labelling these innovations as ‘brown’ or ‘dirty’, as their technologies do not necessarily contribute to environmental harm.

4. Preliminary descriptive evidence

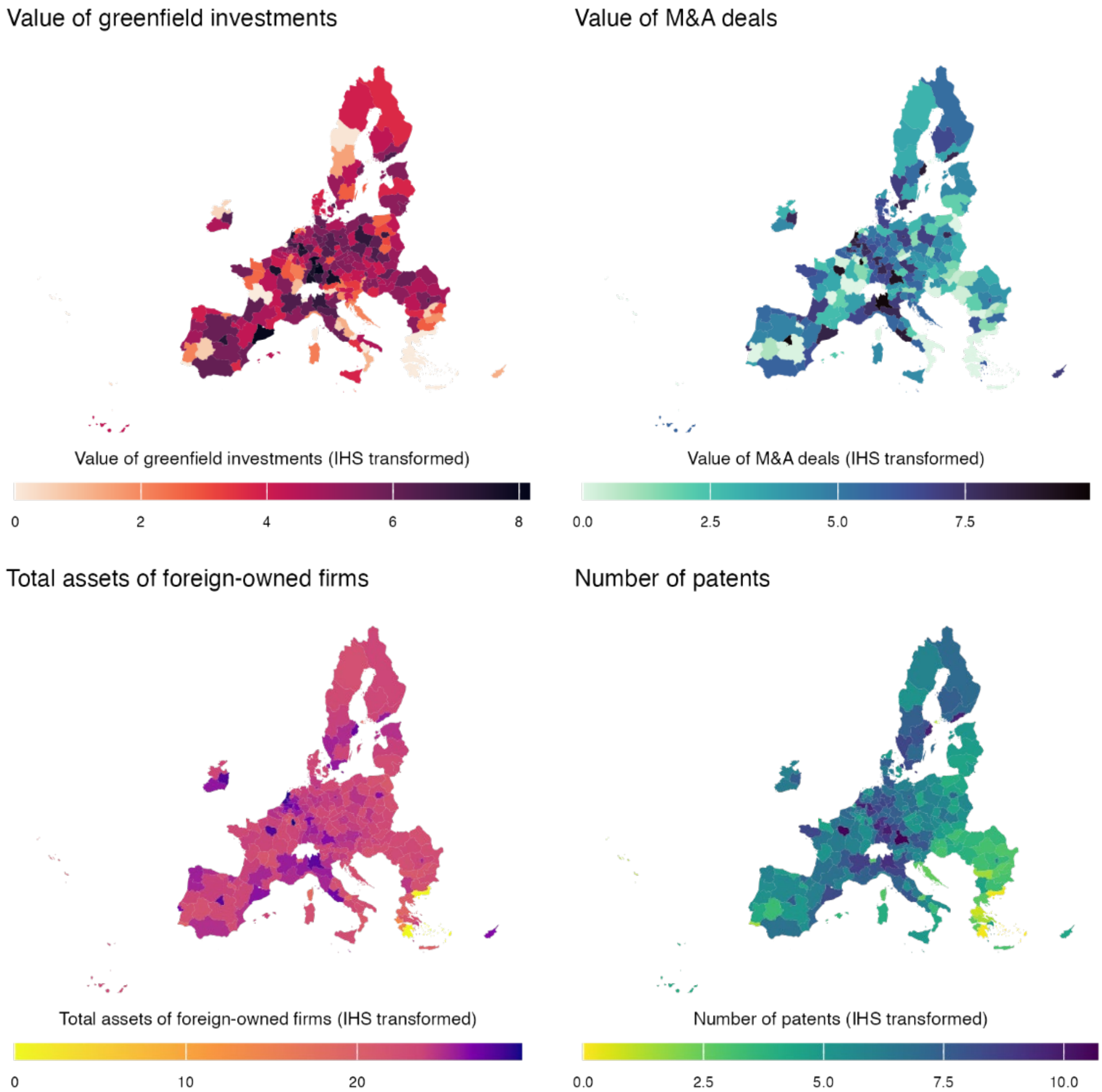
In our analysis, we utilise seven different proxies for FDI: (1) total assets of foreign-owned firms; (2 and 3) number and value of greenfield investments, respectively; (4 and 5) number and value of M&A deals, respectively; (6 and 7) innovation by foreign-owned subsidiaries and their corporate group, respectively. Figure 1 depicts the geographical distribution of three financial measures of FDI and the number of patents owned by foreign-owned subsidiaries across the EU's NUTS 2 regions (2016 version). More detailed statistics on regional FDI distribution can be found in Appendix B. It is worth noticing the close correspondence between the distribution of total assets of foreign-owned firms and the distribution of patents. Similarly, Table 1 presents information on FDI and patenting activity in the top 10 regions with the most patents between 2008 and 2018. Columns 7-12 of the table indicate each region's position in the respective regional rankings for each variable. Notably, the regions with the highest patenting activity also rank high in the other FDI-related metrics, underscoring the presence of innovative FDI in the EU. Further evidence is provided in Table 2, which presents the pairwise correlation between the six rankings. All correlations are very high. In particular, there is a very strong correlation between the ranking in the number of published patents and both M&A activities and total assets of foreign-owned firms. These pieces of empirical evidence suggest the existence of regional and industry characteristics that not only attract FDI but also facilitate innovation processes.

Table 1 / Top 10 patenting regions

		Value						Ranking					
NUTS 2 code	**Region**	**GF num.** (1)	**GF value (in EUR thsd.)** (2)	**M&A num.** (3)	**M&A value (in EUR thsd.)** (4)	**TA FO firms (in EUR m)** (5)	**Patents num.** (6)	**GF num.** (7)	**GF value (in EUR thsd.)** (8)	**M&A num.** (9)	**M&A value (in EUR thsd.)** (10)	**TA FO firms (in EUR m)** (11)	**Patents num.** (12)
DE21	Oberbayern	111	1,158	25	4,912	151,754	27,993	4	4	12	6	19	1
FR10	Île-de-France	91	996	31	4,915	776,694	26,631	8	8	9	5	4	2
SE11	Stockholm	20	148	35	3,195	374,065	12,630	56	56	7	7	9	3
DE11	Stuttgart	136	1,752	12	1,664	70,595	11,961	1	1	23	17	37	4
NL41	Noord-Brabant	17	459	18	2,240	448,647	11,397	18	18	16	9	8	5
DEA1	Düsseldorf	152	1,139	15	1,708	232,584	10,404	6	6	18	13	13	6
FI1B	Helsinki-Uusimaa	36	335	29	1,630	88,468	9,719	21	21	10	18	30	7
DEB3	Rheinhessen-Pfalz	6	142	4	330	11,811	8,436	59	59	76	51	103	8
ITC4	Lombardia	62	586	49	8,531	524,423	8,321	14	14	4	3	7	9

Note: We report in the table the top 10 European patenting regions. Columns 1-6 contain the average values of the FDI measures and the number of published patents in each region over the 2008-2018 period. Columns 7-12 report the corresponding position of the region in the ranking of each variable.

Figure 1 / Geographical distribution of FDIs and number of published patents across Europe



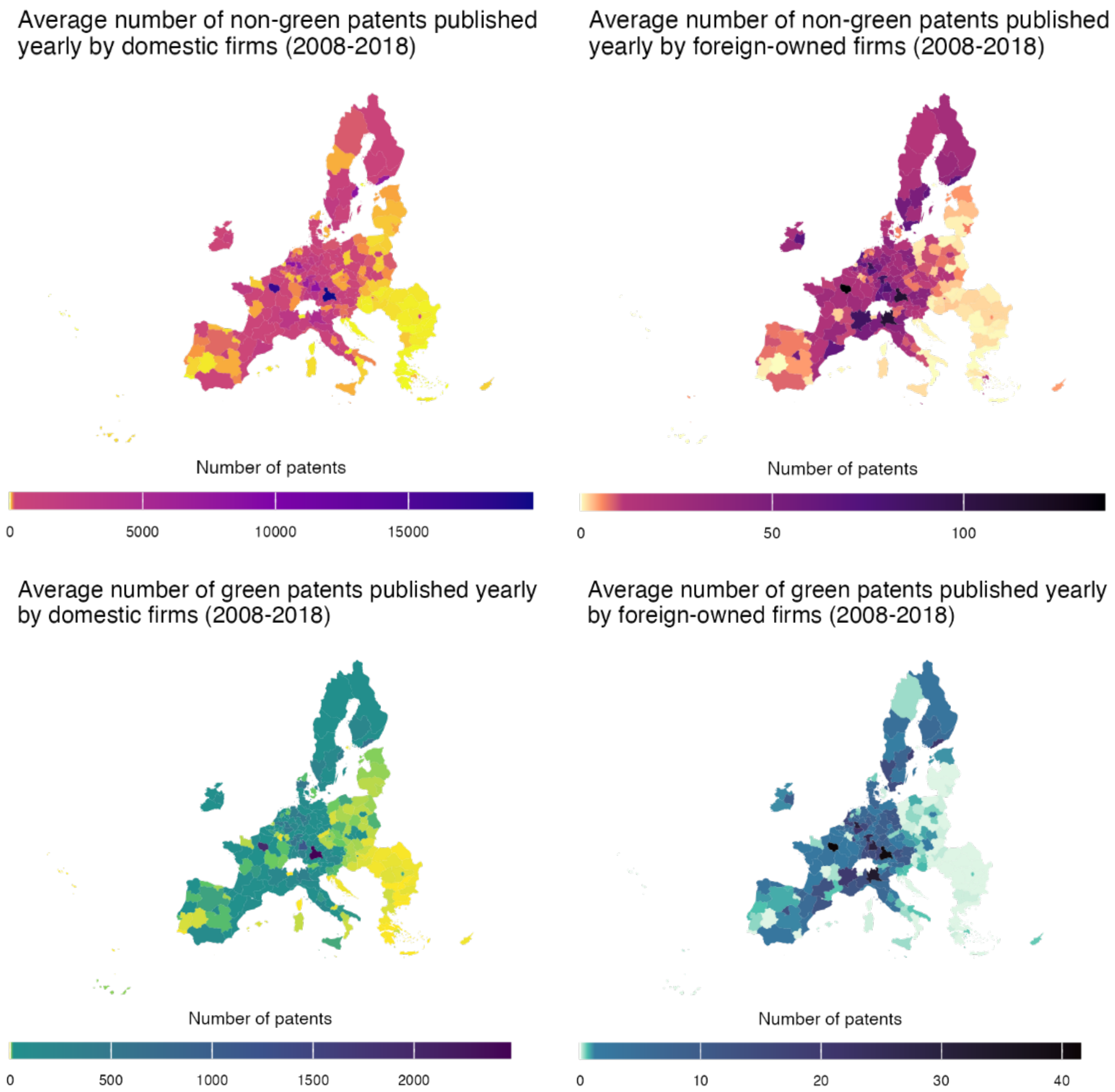
Note: All variables are inverse hyperbolic sine (IHS) transformed to account for the skewness of their distribution. Moreover, they represent the yearly average values in the 2008-2018 period

Table 2 / Pairwise correlations between the regional rankings of FDI and patenting activity

	Patents number	GF number	GF value	M&A number	M&A value	Total FO assets
Patents number	1	0.613293	0.609807	0.703	0.721096	0.743976
GF number		1	0.999054	0.659434	0.6205	0.685792
GF value			1	0.657727	0.619175	0.682064
M&A number				1	0.835581	0.809867
M&A value					1	0.794404
Total FO assets						1

Figure 2 provides a comparative analysis of the average number of patents published annually between 2008 and 2018 across European regions. The focus is on the contributions of domestic and foreign-owned firms, distinguishing between green and non-green innovations. The top-left panel indicates that non-green innovation by domestic firms is predominantly concentrated in economically advanced regions of Western and Central Europe, such as Germany, France and the Benelux countries. In contrast, innovation activity is significantly lower in Eastern and Southern Europe. The top-right panel shows that foreign-owned firms contribute substantially to non-green innovation in already highly innovative regions, such as the Netherlands, parts of Scandinavia, and parts of Central Europe. These firms also potentially play a bridging role in areas where domestic innovation is comparatively weaker.

Figure 2 / Geographical distribution of green and non-green published patents across Europe for domestic firms and foreign-owned local subsidiaries



Note: All variables represent the yearly average values for each NUTS 2 region in the 2008-2018 period.

The bottom-left panel examines green innovation by domestic firms. While it is less geographically concentrated than non-green innovation, it follows a similar pattern, with green innovation thriving in regions where non-green innovation is also prominent. Similarly, the bottom-right panel shows that green innovation by foreign-owned firms is geographically concentrated in parts of Central Europe and Scandinavia. This observation confirms the presence of a strong correlation between green and non-green innovation, suggesting that foreign-owned firms may strategically focus their green innovation efforts in regions that are already environmentally progressive.

Figure 2 may offer valuable insights into the interplay between domestic and foreign-owned firms. The overlap in innovation hotspots highlights the potential for knowledge spill-overs, where foreign subsidiaries may enhance the innovative capacity of domestic firms through collaboration, competition or sharing expertise. This interaction is particularly significant with green innovation, where the strategic presence of foreign-owned firms could drive the adoption, diffusion and development of sustainable technologies by domestic firms. However, the regional disparities evident in the maps underscore the urgent need for policies aimed at ensuring the diffusion of innovation to less-developed areas. By harnessing the innovative potential of foreign-owned subsidiaries, policy makers could promote balanced economic development and environmental sustainability across Europe.

5. Econometric model of spill-overs to regional innovation

This analysis estimates how various measures of FDI in regional sectors of the EU affect innovation and patenting in those sectors in the following year, focusing exclusively on domestic firms or firms within domestic groups. Patents serve as our measure of technological advancements resulting from successful R&D activities. The equation to be estimated is as follows:

$$\begin{aligned} P_{rcst} = \exp[&\beta_0 + \beta_{FDI} FDI^{\tau}_{rcst-1} + \beta_2 TBT_{cst-1} + \beta_3 SPS_{cst-1} + \beta_4 Tariff_{cst-1} + \beta_5 STRI_{cst-1} \\ &+ \beta_6 Prod_{rcst-1} + \beta_7 kl_{rcst-1} + \beta_8 GDP_{rct-1} + \beta_9 R\&D_{rct-1} + \beta_{10} Edu_{rct-1} \\ &+ \beta_{11} Comp_{rcst-1} + \beta_{12} Agg_{rcst-1} + \alpha_r + \gamma_s + \delta_t] + \epsilon_{rcst} \end{aligned} \quad (1)$$

Here, P_{rcst} represents the number of patents owned by all domestic firms operating in sector s and region r of country c, published at time t. The primary variable of interest is FDI^{τ}_{rcst-1} of type τ, one of 11 FDI measures from the previous year: (1) total assets of foreign-owned firms (FDI^{k}_{rcst-1}), (2 and 3) greenfield investments (number FDI^{nGF}_{rcst-1} and value FDI^{vGF}_{rcst-1}), (4 and 5) M&A deals (number $FDI^{nM\&A}_{rcst-1}$ and value $FDI^{vM\&A}_{rcst-1}$), and (6 to 11) innovation activity measured in number of patents published in the previous year by foreign-owned local subsidiaries ($FDI^{P^{FO}}_{rcst-1}$), including green patents ($FDI^{P^{FO}_{G}}_{rcst-1}$) and non-green patents ($FDI^{P^{FO}_{G'}}_{rcst-1}$) as well as those owned by the parent or parent group of the local foreign-owned subsidiary (respectively, $FDI^{P^{Parent}}_{rcst-1}$, $FDI^{P^{Parent}_{G}}_{rcst-1}$, $FDI^{P^{Parent}_{G'}}_{rcst-1}$, $FDI^{P^{Group}}_{rcst-1}$, $FDI^{P^{Group}_{G}}_{rcst-1}$, $FDI^{P^{Group}_{G'}}_{rcst-1}$). The first five types above are traditional financial FDI measures, while the rest reflect technological FDI flows. Total assets measure FDI stocks, whereas the others measure financial and technological FDI flows.

We include a set of control variables to account for year-industry-specific shocks that may influence both the innovation activity and FDI intensity of firms. These controls include tariffs and non-tariff measures (NTMs), which can impact the EU's technological development and act as drivers of FDI. Tariffs may vary across trading partners depending on their preferential trade agreements with the EU, while TBTs and SPS measures are unilateral measures imposed on imports from all extra-EU trading partners. These are calculated as weighted averages of tariffs and the stock of NTMs imposed by country c on sector s vis-à-vis all trade partners, with weights based on sector imports from each partner.

In the EU's single market, regulatory NTMs are typically imposed by EU bodies (e.g. the European Parliament) and harmonised across all member states. However, individual member states can impose their own regulatory NTMs independently. Mutual recognition within the single market ensures that goods traded within the EU are not subject to border inspections, while imports from extra-EU countries must comply with both the EU's NTMs and any additional NTMs imposed by individual member states. Consequently, variations across member states can still be observed even when using simple averages of NTMs.

Additionally, we include the variable $Prod$, measured as the ratio of operating revenues to the number of employees, to capture productivity shocks in the sector and region. The variable kl_{rcst-1} represents the capital-to-labour ratio in region r and sector s of country c. This ratio is influenced by both the presence of FDI (Hijzen et al. 2011) and improvements in human capital (Toner 2011), which in turn positively affect innovation. To account for market size, we include the logarithm of GDP, and for research and development (R&D) activity, we control for total R&D expenditure and the share of the tertiary-educated population. Both are positively correlated with innovation and attract FDI.

$Comp_{rcst-1}$ serves as a proxy for intra-sectoral and intra-regional competition and is measured using the Hirschman-Herfindahl Index (HHI) computed on the summation of squared share of firm f's relative to total employment in a regional industry: $Comp_{rcst-1} = \sum_f \left(\frac{L_{frcst-1}}{L_{rcst-1}}\right)^2$. This variable converges to unity in the case of a monopoly in a regional sector, and to zero in the case of perfect competition. Agg_{rcst-1} measures the agglomeration of labour employed in sector s in region r in year $t-1$ to the total employed labour in that region. This variable acts as a proxy for Marshall-Arrow-Romer (MAR) localisation externalities associated with sectoral knowledge spill-overs (Marshall 1890; Arrow 1962; Romer 1986; see Glaeser et al. 1992). Finally, consistent with the literature, we include fixed effects for time, region (at the NUTS 2 level) and industry (at the NACE Rev. 2 two-digit level) to control for unobservable shocks.

Since the dependent variable is a count measure that includes zero values for the number of published patents in a regional sector in a given year, we estimate the equation using the Poisson pseudo-maximum likelihood (PPML) method proposed by Santos Silva and Tenreyro (2006) and implemented in Stata by Correia et al. (2019, 2020). To address the prevalence of zeros, all trade and FDI variables are transformed using the inverse hyperbolic sine (IHS) function. This transformation, similar to logarithmic scaling, provides an asymptotic elasticity when a variable is large (Bellemare and Wichman 2020; Mullahy and Norton 2024; Chen and Roth 2024). However, as Chen and Roth (2024) emphasise, when the variable approaches zero, interpreting coefficients as marginal or percentage effects becomes problematic. Therefore, for variables with small values (e.g. ratios), we only discuss their significance and sign without interpreting the size or magnitude of the coefficients. Thus, for FDI measures that are usually large values, a 1% increase in the transformed independent variable leads to an approximately β_{FDI} percent change in the number of patents. For small FDI measures, the relationship behaves linearly, where the coefficient directly indicates the change in patent counts for a 1% change in the transformed FDI measures.

We later focus exclusively on the publication of green patents owned by domestic firms in a regional sector (GP_{trcs}). To identify green patents, we use the classification provided by Haščič and Migotto (2015) and aggregate the number of patents citing CPC environmental classes, as discussed in the data section above. This allows us to specifically assess the effect of FDI on green innovation. To control for scale effects related to sectoral and regional innovation, we include a control variable for the number of non-green patents ($P_{G',rcst-1}$) published at $t-1$ by domestic firms in the same industry and region. The corresponding equation is as follows:

$$\begin{aligned} P_{G,rcst} = \exp\big[&\beta_0 + \beta_{FDI} FDI^{\tau}_{rcst-1} + \beta_2 TBT_{cst-1} + \beta_3 SPS_{cst-1} + \beta_4 Tariff_{cst-1} + \beta_5 STRI_{cst-1} \\ &+ \beta_6 Prod_{rcst-1} + \beta_7 kl_{rcst-1} + \beta_8 GDP_{rct-1} + \beta_9 R\&D_{rct-1} + \beta_{10} Edu_{rct-1} \\ &+ \beta_{11} Comp_{rcst-1} + \beta_{12} Agg_{rcst-1} + \beta_{13} P_{G',rcst-1} + \alpha_r + \gamma_s + \delta_t\big] + \epsilon_{rcstr} \end{aligned} \tag{2}$$

Here, the dependent variable $P_{G,rcst}$ counts the number of green patents published in year t within region r of country c in industry s. The control variable $P_{G',rcst-1}$ represents the number of non-green patents published in $t-1$ in the same region, country and industry, serving as a proxy for overall innovation activity within the sector and region. This accounts for broader technological dynamics that may influence green innovation.

6. Empirical results of spill-overs to regional innovation

Table 3 presents the estimation results of equation (1), where the dependent variable is the number of all patents published in a year and owned by domestic firms aggregated to the regional industries. These models across various columns present the coefficients of alternative proxies for FDI measures of type τ. Notably, all measures of FDI exhibit positive and statistically significant coefficients even after accounting for specific sector and regional characteristics that might influence both FDI incentives and the innovation environment.

While the effects of different FDI measures across various estimation equations (presented in different columns of Table 3) cannot be directly compared, the largest coefficients are associated with the number of M&A deals in a regional sector and technological FDI measures. Specifically, the largest coefficient is attributed to the number of patents published in the previous year by the groups of parent companies of the foreign-owned local subsidiaries (FDI^{PGroup}_{rcst-1}), excluding the local subsidiaries themselves. This strongest impact is observed when the number of patents published in the previous year by the local subsidiaries (FDI^{PFO}_{rcst-1}) is not controlled for, as shown in columns 8 and 10.

As we use PPML estimation, the interpretation of the dependent variable is considered analogous to its logarithmic form in an ordinary least squares (OLS) estimation even though it is included in levels in the PPML model. Meanwhile, the independent variable is transformed using IHS transformation. As explained above when discussing the interpretation of independent variables with large values, they can be interpreted as elasticities. Accordingly, a 1% increase in the number of patents published within the group or by the parent is associated with an approximately 0.255% and 0.158% increase, respectively, in the aggregated number of patents published by domestic firms operating in the same sector and region as the local foreign-owned subsidiary. In contrast, in columns 10 and 11, the effect of the number of patents published by the local foreign-owned subsidiaries themselves (FDI^{PFO}_{rcst-1}) becomes less significant when including the number of patents owned by the group and the parent, respectively, compared to the other models. This finding underscores the critical role of innovation within the corporate ownership boundary of an MNE in facilitating knowledge spill-overs to domestic firms located globally. It suggests that subsidiaries of multinational corporations not only contribute directly to the technological advancement of the host economy through their own innovation activities but also stimulate innovation in local firms through their innovation activities in other parts of the world.

It is important to note that in columns 9, 10 and 11, the coefficients for group and parent innovation are reported in addition to the effect of the technology produced by the local subsidiaries, which is included as a control variable in all regressions. The innovation produced by the local subsidiaries is more likely endogenous to the characteristics of the regional industry and thus serves as an additional control for potential reverse causality.

Consistent with the relevance of multinational corporations, the second-strongest coefficient is associated with the number of M&A deals ($FDI_{rcst-1}^{nM\&A}$) in the region during the previous year. A 1% increase in the number of M&A deals corresponds to a 0.241% increase in published patents. The value of foreign M&A deals in a regional industry ($FDI_{rcst-1}^{vM\&A}$) is also correlated with the number of patents in a regional industry, but with a lower magnitude than the number of deals. This discrepancy could be attributed to the fact that many M&A deals very frequently lack information about their values in the used data. Nevertheless, increased M&A activity provides domestic firms with access to funding and knowledge from parent companies, thereby stimulating innovation activities. If some of this knowledge spills over into the network of M&A targets, an even more significant effect on the sector and region could be expected. Conversely, larger M&A values may be concentrated in a few large targets, potentially limiting their broader impact on the firms' market. The number of greenfield investments (FDI_{rcst-1}^{nGF}) in a regional industry is also highly correlated with the number of patents in that regional industry, while their value (FDI_{rcst-1}^{vGF}) is less strongly correlated with the number of patents in the regional industry.

Another important measure of FDI is the aggregated total assets of the local foreign-owned firms (FDI_{rcst-1}^{k}) in a regional sector, which serves as a classical proxy for FDI stock in the regional sector. It is worth noting that innovation, as measured by patents, takes time to materialise. Consequently, an increase in the total assets of foreign-owned firms – benefiting from the resources and knowledge of their parent companies and maintaining a longer-established relationship with the local market – may propagate more readily throughout the firms' markets.

As for the other control variables included in all models, most of them exhibit similar and consistent behaviour across columns. While TBTs, tariffs and STRI do not yield any significant coefficients across columns, SPS measures have significant and positive coefficients throughout the models. This indicates that sectors experiencing an increase in regulations – measured by the cumulative number of SPS measures imposed on imports, which typically address hygiene and safety standards – tend to have greater patenting activity. Specifically, according to column 1, when the cumulative number of SPS measures imposed on the imports of a sector increases by 1%, the number of patents published in that sector in that country rises by approximately 3.120%.

Labour productivity in a regional sector is positively and significantly associated with the number of patents published by domestic firms, but only in models where FDI is proxied through non-technological channels (i.e. greenfield investments, M&As and the total assets of foreign-owned firms). This result indicates that productivity gains in domestic firms are more likely to translate into patenting activity when a foreign presence contributes to the broader economic environment rather than dominating the innovation process. Otherwise, innovation by foreign-owned firms, as measured by their patents, would become the main control for technological spill-overs in regional sectors, rendering regional-sectoral labour productivity statistically unrelated to domestic patenting activity.

In contrast, regional sectors with larger capital-to-labour ratios and regions with larger markets, measured by GDP, exhibit higher patenting activity across all models. R&D expenditures display negative coefficients, though these remain statistically insignificant, while higher levels of education are associated with positive but likewise insignificant effects. Competition, measured using the HHI, indicates that when the market structure in a regional sector converges towards a monopoly (as reflected in larger values of this index), the number of patents also increases. This suggests that domestic firms, by publishing patents and potentially receiving grants thereafter, have gained market share in their regional sector. Furthermore, agglomeration externalities, measured by the concentration of labour in a sector within a region, yield a positive and significant coefficient, confirming the presence of MAR localisation externalities.

Tables 4 and 5 present the correlations between different types of FDI and green innovation, measured as the number of green patents produced in regional industries. When focusing specifically on green innovation, we find that M&As, greenfield investments and the assets of foreign-owned firms are not significantly correlated with green patenting activity. Likewise, the innovation produced by foreign-owned local subsidiaries and their parent corporate groups shows no significant correlation with green innovation in the regional industry. However, a different pattern emerges for the ultimate parent companies of foreign-owned subsidiaries. In this case, we find a negative and statistically significant correlation between the parent firms' innovation activity and regional green patenting. This correlation becomes stronger when controlling for the innovation output of the local foreign-owned subsidiaries (column 9) and their corporate groups (column 11).

Table 5 refines the analysis by distinguishing between green and non-green patents of foreign-owned subsidiaries and of their parents. Instead of relying on the total number of patents, we separately consider green and non-green patenting activity by the foreign subsidiaries, their parent companies and their corporate groups. This approach allows us to examine whether observed correlations are associated with the specific technological focus of MNEs or whether regional green innovation is independent of the foreign investor's specialisation.

When focusing on foreign-owned local subsidiaries, we find a negative and significant correlation between their green patenting activity and green patent production in the host regional industry. Therefore, the data indicate that their innovation in green technological classes by foreign-owned subsidiaries is not associated with increased green innovation in the host regional sectors and may even be negatively correlated with it. This could reflect limited knowledge spill-overs in cases where foreign subsidiaries compete directly with local firms in the same technological classes and protect their proprietary technologies. By contrast, their non-green innovation is positively correlated with local green innovation, although the correlation only becomes significant when controlling for parent- or group-level innovation (columns 4-6). For parent companies and corporate groups, the opposite holds. Their green innovation is positively and significantly correlated with domestic green patenting in most specifications, while their non-green innovation is negatively correlated with local green innovation. Therefore, the green innovation of parent companies is more broadly correlated with domestic green innovation, suggesting that environmentally relevant knowledge originating at the group level located in other parts of the world may spread to local markets even if not directly through the subsidiaries.

When examining the corporate group as a whole, a clear pattern emerges: if the group is specialised in green technologies, its innovation is positively associated with green innovation by domestic firms. If, instead, the group's innovation is primarily non-green, the correlation with domestic green innovation turns negative. This suggests that the technological focus of foreign groups plays a role in shaping domestic innovation patterns, potentially by influencing the direction of innovation in the local supply chain or competitive environment.

An additional result relates to the correlation between non-green patents owned by domestic firms in a regional industry ($P_{G',rcst-1}$) and regional industrial green innovation. Across all specifications, we observe a positive and significant relationship between the two. Specifically, a 1% increase in non-green patents by domestic firms is associated with a 0.7% increase in green patents in the same region and sector. This indicates that green and non-green innovation are jointly produced and should be analysed together. Controlling for domestic non-green innovation is thus important to accurately assess the specific correlation between FDI and green-innovation outcomes.

As for the remaining control variables, their behaviour is broadly consistent with the patterns observed in Table 3, with the exception of productivity, which is no longer statistically significant. This loss of significance is likely due to the inclusion of a control for non-green innovation produced in the regional industry, which may capture a substantial portion of the variation previously attributed to productivity. Additionally, the effect of competition now appears to be negative and statistically significant across all specifications -unlike in Table 3- suggesting that, in the context of green innovation, competitive pressures may incentivise firms to innovate in order to preserve or expand their market position.

Table 3 / PPML estimation results for the aggregated regional industrial number of patents owned by domestic firms

Dep. Var. P_{rcst} FDI measure type τ:	(1) FDI^{k}_{rcst-1}	(2) FDI^{nGF}_{rcst-1}	(3) FDI^{vGF}_{rcst-1}	(4) $FDI^{nM\&A}_{rcst-1}$	(5) $FDI^{vM\&A}_{rcst-1}$	(6) $FDI^{p^{FO}}_{rcst-1}$	(7) $FDI^{p^{Parent}}_{rcst-1}$	(8) $FDI^{p^{Group}}_{rcst-1}$	(9) $FDI^{p^{FO}}_{rcst-1}$	(10) $FDI^{p^{FO}}_{rcst-1}$	(11) $FDI^{p^{FO}}_{rcst-1}$
FDI^{τ}_{rcst-1}	0.0211***	0.0681*	0.0478**	0.241***	0.0541***	0.136***			0.0541***	0.0172	0.0105
	(0.00564)	(0.0307)	(0.0162)	(0.0502)	(0.0150)	(0.0146)			(0.0145)	(0.0141)	(0.0142)
$FDI^{p^{Parent}}_{rcst-1}$							0.158***		0.145***		0.0338**
							(0.0103)		(0.0110)		(0.0110)
$FDI^{p^{Group}}_{rcst-1}$								0.255***		0.249***	0.225***
								(0.0144)		(0.0154)	(0.0171)
TBT_{cst-1}	-0.107	-0.109	-0.107	-0.128	-0.123	-0.101	-0.110	-0.0819	-0.104	-0.0808	-0.0830
	(0.0863)	(0.0853)	(0.0854)	(0.0850)	(0.0859)	(0.0857)	(0.0848)	(0.0872)	(0.0847)	(0.0871)	(0.0867)
SPS_{cst-1}	3.120***	3.075***	3.083***	3.010***	3.039***	3.310***	3.160***	3.230***	3.253***	3.256***	3.247***
	(0.450)	(0.447)	(0.447)	(0.447)	(0.444)	(0.452)	(0.395)	(0.432)	(0.399)	(0.435)	(0.423)
$Tariff_{cst-1}$	0.189	0.185	0.180	0.127	0.147	0.219	0.122	0.0567	0.138	0.0636	0.0549
	(0.241)	(0.240)	(0.240)	(0.239)	(0.240)	(0.241)	(0.231)	(0.235)	(0.232)	(0.235)	(0.234)
$STRI_{cst-1}$	-0.708	-0.842	-0.803	-0.904	-0.682	-0.578	-0.695	-0.581	-0.631	-0.562	-0.587
	(0.547)	(0.560)	(0.553)	(0.556)	(0.548)	(0.558)	(0.556)	(0.551)	(0.557)	(0.551)	(0.553)
$Prod_{rcst-1}$	0.0718*	0.0822**	0.0819**	0.0770*	0.0780*	0.0578	0.0369	0.0191	0.0308	0.0166	0.0153
	(0.0326)	(0.0316)	(0.0316)	(0.0311)	(0.0312)	(0.0322)	(0.0319)	(0.0339)	(0.0318)	(0.0339)	(0.0336)
kl_{rcst-1}	0.257***	0.264***	0.262***	0.262***	0.262***	0.244***	0.245***	0.229***	0.238***	0.228***	0.227***
	(0.0218)	(0.0217)	(0.0216)	(0.0213)	(0.0214)	(0.0228)	(0.0219)	(0.0222)	(0.0224)	(0.0223)	(0.0223)
GDP_{rct-1}	1.943*	1.764*	1.761*	1.742*	1.784*	1.768*	2.025**	2.090**	1.947**	2.063**	2.071**
	(0.763)	(0.763)	(0.764)	(0.750)	(0.758)	(0.766)	(0.747)	(0.749)	(0.752)	(0.751)	(0.751)
$R\&D_{rct-1}$	-0.178	-0.163	-0.163	-0.180	-0.180	-0.164	-0.157	-0.167	-0.148	-0.165	-0.164
	(0.115)	(0.114)	(0.115)	(0.116)	(0.116)	(0.116)	(0.109)	(0.113)	(0.109)	(0.112)	(0.111)
Edu_{rct-1}	0.00632	0.00687	0.00696	0.00488	0.00636	0.00588	0.00585	0.00753	0.00574	0.00749	0.00726
	(0.00623)	(0.00616)	(0.00616)	(0.00612)	(0.00618)	(0.00605)	(0.00587)	(0.00599)	(0.00584)	(0.00598)	(0.00593)
$Comp_{rcst-1}$	0.000233***	0.000230***	0.000231***	0.000193***	0.000214***	0.000203***	0.000152**	0.000210***	0.000145**	0.000206***	0.000189***
	(0.0000357)	(0.0000360)	(0.0000361)	(0.0000450)	(0.0000392)	(0.0000378)	(0.0000475)	(0.0000438)	(0.0000479)	(0.0000437)	(0.0000458)
Agg_{rcst-1}	10.33***	10.49***	10.40***	10.29***	10.49***	10.29***	9.782***	9.692***	9.752***	9.675***	9.593***
	(1.113)	(1.117)	(1.117)	(1.108)	(1.120)	(1.088)	(1.028)	(1.033)	(1.027)	(1.032)	(1.026)
Constant	-22.68*	-20.54*	-20.50*	-19.95*	-20.48*	-20.49*	-23.64**	-25.12**	-22.79**	-24.80**	-24.84**
	(8.862)	(8.854)	(8.864)	(8.695)	(8.783)	(8.872)	(8.667)	(8.685)	(8.717)	(8.711)	(8.707)
No. of observations	93,439	93,439	93,439	93,439	93,439	93,439	93,439	93,439	93,439	93,439	93,439
Regional FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
AIC	4,313,884.37	4,317,536.27	4,312,212.00	4,291,537.25	4,305,647.81	4,216,850.43	4,011,658.87	3,782,632.14	3,997,375.43	3,781,132.78	3,771,866.81
BIC	4,314,007.16	4,317,659.05	4,312,334.78	4,291,660.03	4,305,770.59	4,216,973.22	4,011,781.66	3,782,754.93	3,997,507.66	3,781,265.01	3,772,008.48

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 4 / PPML Estimation results for the aggregated regional industrial number of green patents owned by domestic firms

Dep. Var. $P_{G,rcst}$ **FDI measure type** τ**:**	**(1)** FDI^{k}_{rcst-1}	**(2)** FDI^{nGF}_{rcst-1}	**(3)** FDI^{vGF}_{rcst-1}	**(4)** $FDI^{nM\&A}_{rcst-1}$	**(5)** $FDI^{vM\&A}_{rcst-1}$	**(6)** $FDI^{p^{FO}}_{rcst-1}$	**(7)** $FDI^{p^{Parent}}_{rcst-1}$	**(8)** $FDI^{p^{Group}}_{rcst-1}$	**(9)** $FDI^{p^{FO}}_{rcst-1}$	**(10)** $FDI^{p^{FO}}_{rcst-1}$	**(11)** $FDI^{p^{FO}}_{rcst-1}$
FDI^{τ}_{rcst-1}	-0.00449	-0.0367	0.000294	0.0407	0.0192	0.0101			0.0276	0.00236	0.0165
	(0.00625)	(0.0271)	(0.0133)	(0.0437)	(0.0141)	(0.0142)			(0.0151)	(0.0157)	(0.0158)
$FDI^{p^{Parent}}_{rcst-1}$							-0.0366***		-0.0427***		-0.0592***
							(0.0103)		(0.0111)		(0.0112)
$FDI^{p^{Group}}_{rcst-1}$								0.0267		0.0260	0.0580***
								(0.0146)		(0.0160)	(0.0167)
$P_{G',rcst-1}$	0.716***	0.717***	0.717***	0.716***	0.716***	0.715***	0.733***	0.701***	0.731***	0.701***	0.706***
	(0.0260)	(0.0259)	(0.0260)	(0.0260)	(0.0260)	(0.0260)	(0.0251)	(0.0238)	(0.0250)	(0.0238)	(0.0231)
TBT_{cst-1}	-0.00601	-0.00243	-0.00473	-0.00916	-0.0113	-0.00529	-0.00851	-0.00167	-0.0111	-0.00190	-0.00464
	(0.0637)	(0.0639)	(0.0643)	(0.0640)	(0.0640)	(0.0637)	(0.0635)	(0.0641)	(0.0626)	(0.0637)	(0.0626)
SPS_{cst-1}	0.551	0.562	0.563	0.531	0.527	0.585	0.608	0.600	0.678*	0.604	0.753*
	(0.320)	(0.321)	(0.321)	(0.314)	(0.318)	(0.323)	(0.324)	(0.314)	(0.331)	(0.319)	(0.325)
$Tariff_{cst-1}$	-0.0366	-0.0196	-0.0295	-0.0452	-0.0509	-0.0203	-0.0182	-0.0441	0.00752	-0.0416	-0.0286
	(0.249)	(0.249)	(0.249)	(0.249)	(0.252)	(0.248)	(0.245)	(0.250)	(0.238)	(0.250)	(0.242)
$STRI_{cst-1}$	0.510	0.547	0.526	0.487	0.525	0.544	0.517	0.537	0.564	0.541	0.568
	(0.542)	(0.541)	(0.544)	(0.544)	(0.545)	(0.546)	(0.541)	(0.544)	(0.543)	(0.546)	(0.541)
$Prod_{rcst-1}$	0.00531	0.00149	0.00272	0.00264	0.00327	0.00101	0.00828	-0.00346	0.00468	-0.00371	-0.00465
	(0.0296)	(0.0293)	(0.0293)	(0.0292)	(0.0291)	(0.0292)	(0.0288)	(0.0282)	(0.0287)	(0.0283)	(0.0277)
kl_{rcst-1}	0.0826**	0.0807**	0.0813**	0.0800**	0.0789**	0.0799**	0.0875***	0.0814**	0.0848***	0.0811**	0.0896***
	(0.0253)	(0.0253)	(0.0252)	(0.0252)	(0.0254)	(0.0253)	(0.0251)	(0.0252)	(0.0249)	(0.0251)	(0.0243)
GDP_{rct-1}	-0.072	0.0283	-0.0915	-0.148	-0.171	-0.0834	-0.101	-0.0165	-0.0875	-0.0169	0.087
	(0.829)	(0.823)	(0.833)	(0.814)	(0.826)	(0.831)	-(0.826)	(0.820)	(0.820)	(0.818)	(0.803)
$R\&D_{rct-1}$	0.104	0.101	0.106	0.102	0.102	0.11	0.104	0.103	0.115	0.104	0.105
	(0.0744)	(0.0743)	(0.0744)	(0.0746)	(0.0746)	(0.0745)	(0.0741)	(0.0741)	(0.0744)	(0.0742)	(0.074)
Edu_{rct-1}	-0.00983	-0.0106	-0.0102	-0.0106	-0.0104	-0.0102	-0.00984	-0.00947	-0.00968	-0.00948	-0.00776
	(0.00594)	(0.00602)	(0.00599)	(0.0059)	(0.00596)	(0.00596)	(0.00588)	(0.00585)	(0.00583)	(0.00583)	(0.0056)
$Comp_{rcst-1}$	-0.000414**	-0.000399**	-0.000409**	-0.000434**	-0.000434**	-0.000415**	-0.000343**	-0.000418**	-0.000350**	-0.000419**	-0.000330*
	(0.000141)	(0.000139)	(0.000140)	(0.000141)	(0.000141)	(0.000140)	(0.000133)	(0.000142)	(0.000133)	(0.000141)	(0.000132)
Agg_{rcst-1}	6.413***	6.409***	6.307***	6.234***	6.312***	6.336***	6.559***	6.145***	6.678***	6.156***	6.436***
	(1.241)	(1.225)	(1.234)	(1.227)	(1.233)	(1.229)	(1.220)	(1.268)	(1.218)	(1.273)	(1.255)
Constant	-1.753	-2.885	-1.567	-0.839	-0.565	-1.686	-1.520	-2.504	-1.757	-2.503	-3.931
	(9.672)	(9.600)	(9.709)	(9.473)	(9.639)	(9.704)	(9.632)	(9.566)	(9.583)	(9.557)	(9.375)
No. of observations	92,089	92,089	92,089	92,089	92,089	92,089	92,089	92,089	92,089	92,089	92,089
Regional FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
AIC	326,872.738	326,812.080	326,915.117	326,850.915	326,746.227	326,870.834	325,849.700	326,599.799	325,555.638	326,599.598	324,400.540
BIC	327,004.765	326,944.108	327,047.144	326,982.942	326,878.254	327,002.861	325,981.728	326,731.826	325,697.095	326,741.056	324,551.428

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 5 / PPML Estimation results for the aggregated regional industrial number of green patents owned by domestic firms for different types and sources of innovation activities

Dep. Var. $P_{G,rcst}$ Innovation activity source:	(1) FO	(2) Parents	(3) Groups	(4) FO and parents	(5) FO and groups	(6) FO, parents and groups
$FDI_{rcst-1}^{P_G^{FO}}$	-0.0457**			-0.0577***	-0.0672***	-0.0651***
	(0.0173)			(0.0168)	(0.0174)	(0.0171)
$FDI_{rcst-1}^{P_{G'}^{FO}}$	0.0325			0.0611***	0.0370*	0.0541**
	(0.0169)			(0.0178)	(0.0183)	(0.0181)
$FDI_{rcst-1}^{P_G^{Parent}}$		0.111***		0.120***		0.0150
		(0.0194)		(0.0188)		(0.0194)
$FDI_{rcst-1}^{P_{G'}^{Parent}}$		-0.126***		-0.139***		-0.0872***
		(0.0166)		(0.0167)		(0.0169)
$FDI_{rcst-1}^{P_G^{Group}}$			0.319***		0.327***	0.338***
			(0.0260)		(0.0263)	(0.0289)
$FDI_{rcst-1}^{P_{G'}^{Group}}$			-0.252***		-0.261***	-0.228***
			(0.0228)		(0.0223)	(0.0223)
$P_{G',rcst-1}$	0.712***	0.732***	0.699***	0.724***	0.695***	0.698***
	(0.0261)	(0.0256)	(0.0248)	(0.0255)	(0.0247)	(0.0240)
TBT_{cst-1}	-0.0143	-0.0186	-0.0285	-0.0339	-0.0414	-0.0451
	(0.0632)	(0.0640)	(0.0638)	(0.0623)	(0.0624)	(0.0611)
SPS_{cst-1}	0.602	0.642*	0.734*	0.750*	0.764*	0.951**
	(0.326)	(0.325)	(0.302)	(0.335)	(0.309)	(0.317)
$Tariff_{cst-1}$	-0.0205	-0.0654	-0.0459	-0.0416	-0.0399	-0.0405
	(0.249)	(0.243)	(0.261)	(0.237)	(0.264)	(0.250)
$STRI_{cst-1}$	0.547	0.574	0.637	0.642	0.675	0.727
	(0.546)	(0.534)	(0.514)	(0.535)	(0.513)	(0.504)
$Prod_{rcst-1}$	0.000297	0.00976	-0.00132	0.00498	-0.00269	-0.00280
	(0.0290)	(0.0288)	(0.0280)	(0.0282)	(0.0275)	(0.0265)
kl_{rcst-1}	0.0894***	0.0790**	0.0782**	0.0883***	0.0916***	0.102***
	(0.0251)	(0.0256)	(0.0246)	(0.0251)	(0.0244)	(0.0239)
GDP_{rct-1}	-0.192	-0.132	0.0132	-0.259	-0.138	0.0269
	(0.827)	(0.825)	(0.813)	(0.814)	(0.804)	(0.782)
$R\&D_{rct-1}$	0.101	0.114	0.113	0.118	0.103	0.111
	(0.0744)	(0.0735)	(0.069)	(0.0737)	(0.0688)	(0.0686)
Edu_{rct-1}	-0.0102	-0.00967	-0.00777	-0.00941	-0.00756	-0.00563
	(0.00593)	(0.00587)	(0.0055)	(0.00578)	(0.00542)	(0.00528)
$Comp_{rcst-1}$	-0.000406**	-0.000339**	-0.000553***	-0.000333*	-0.000538***	-0.000421**
	(0.000140)	(0.000132)	(0.000145)	(0.000131)	(0.000143)	(0.000133)
Agg_{rcst-1}	6.433***	6.598***	5.742***	6.868***	5.957***	6.406***
	(1.219)	(1.224)	(1.308)	(1.214)	(1.279)	(1.233)
Constant	-0.478	-1.044	-2.616	0.256	-0.942	-3.168
	(9.663)	(9.614)	(9.480)	(9.510)	(9.377)	(9.134)
No. of observations	92,089	92,089	92,089	92,089	92,089	92,089
Regional FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
AIC	326,446.16	323,198.11	313,760.87	322,123.81	312,854.89	309,457.03
BIC	326,587.62	323,339.57	313,902.33	322,284.13	313,015.21	309,636.21

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

7. Econometric model of spill-overs to firm-level innovation

Having explored the effect of FDI on innovation at the regional-industry level, we now move to a firm-level analysis to capture more granular insights into the relationship between FDI and innovation. This shift allows us to examine the direct impact of foreign ownership and group-level activities on the innovation outputs of individual domestic firms. By leveraging firm-level data, we are able to control for heterogeneity in firm characteristics (e.g. size, age and sectoral specialisation), which are often obscured in aggregate analyses.

Therefore, in this analysis, we try to estimate how different measures of FDI in the EU's regional industries, in each year, influence innovation and patenting in the EU's domestic firms in the following year. Again, we consider patents as a measure of technological advancements and estimate the following model:

$$\begin{aligned} P_{frcst} = \exp\big[&\beta_0 + \beta_{FDI} FDI^{\tau}_{rcst-1} + \beta_2 TBT_{cst-1} + \beta_3 SPS_{cst-1} + \beta_4 Tariffs_{cst-1} + \beta_5 STRI_{cst-1} \\ &+ \beta_6 Prod_{ft-1} + \beta_7 kl_{ft-1} + \beta_8 GDP_{rct-1} + \beta_9 R\&D_{rct-1} + \beta_{10} Edu_{rct-1} \\ &+ \beta_{11} Comp_{rcst-1} + \beta_{12} Agg_{rcst-1} + \beta_{13} P^{Domestic}_{rcst-1}, + \phi_f + \delta_t\big] + \epsilon_{frcst} \end{aligned} \quad (3)$$

In this specification, productivity and the capital-to-labour ratio are estimated at the firm level, drawing on information from financial accounts. Similarly, sector- and region-fixed effects are replaced with firm-fixed effects. It is important to note that, in our dataset, there is no variation in the sector or region associated with each firm. As a result, sector- and region-fixed effects are inherently absorbed by the firm-fixed effects. However, the sector and region control variables remain consistent with those used in the previous analysis.

Additionally, this specification introduces a new variable that captures the number of patents produced by other domestic companies within the same industry and region in the preceding year ($t-1$). This control variable is intended to isolate the impact of FDI on the domestic firm by accounting for the broader innovation activity occurring within its domestic market.

Building on the regional-sector analysis, we further narrow our focus to green innovation. To account for scale effects associated with the firm's overall innovation capacity, we include as a control variable the number of non-green patents produced by the same domestic firm in the preceding year ($t-1$). For the analysis of the green innovation, we estimate the following model:

$$\begin{aligned} P_{G,frcst} = \exp\big[&\beta_0 + \beta_{FDI} FDI^{\tau}_{rcst-1} + \beta_2 TBT_{cst-1} + \beta_3 SPS_{cst-1} + \beta_4 Tariffs_{cst-1} + \beta_5 STRI_{cst-1} \\ &+ \beta_6 Prod_{ft-1} + \beta_7 kl_{ft-1} + \beta_8 GDP_{rct-1} + \beta_9 R\&D_{rct-1} + \beta_{10} Edu_{rct-1} \\ &+ \beta_{11} Comp_{rcst-1} + \beta_{12} Agg_{rcst-1} + \beta_{13} P^{Domestic}_{rcst-1} + \beta_{14} P_{G',ft-1} + \phi_f + \delta_t\big] + \epsilon_{frcst} \end{aligned} \quad (4)$$

In this specification, the dependent variable $P_{G,ft}$ captures the number of green patents produced by firm f at time t, providing a measure of the firm's contributions to environmentally sustainable innovation. To control for the firm's overall innovative activity and capacity, we include $P_{G',ft-1}$, which represents the number of non-green patents produced by the same firm in the preceding year $(t-1)$. This control is critical, as it accounts for the firm's baseline innovation level, enabling us to isolate the specific factors influencing green innovation.

8. Empirical results of spill-overs to firm-level innovation

Table 6 presents the estimation results of equation (3), applying a PPML estimator to firm-level data. The dependent variable is now the number of patents published by a domestic firm, and the regressions include firm- and year-fixed effects to account for unobserved heterogeneity.

Unlike the findings at the regional-sector level, the results at the firm level show that FDI channels (e.g. M&A activity, greenfield investments and direct patenting by local foreign-owned subsidiaries) are no longer statistically significant in explaining domestic innovation. This divergence across levels of analysis suggests that broader transactional forms of FDI may shape the regional innovation environment but fail to generate direct spill-overs at the level of the individual firm.

Instead, the most robust channels of knowledge diffusion appear to be linked to deeper structural relationships within MNE networks. Specifically, the total assets of foreign-owned subsidiaries (FDI^{k}_{rcst-1}) as well as the patenting activity of their parent ($FDI^{P^{Parent}}_{rcst-1}$) and corporate group ($FDI^{P^{Group}}_{rcst-1}$) are all positively and significantly correlated with patenting by domestic firms. A 1% increase in these proxies is associated with an estimated 0.013%, 0.05% and 0.04% increase in domestic firm patenting, respectively. These results underscore the importance of international innovation networks and financial embeddedness over local operational activities in transmitting knowledge to domestic firms. Policy makers aiming to enhance innovation in domestic firms are therefore encouraged to attract investment from innovative foreign MNEs that possess a substantial number of patents, either directly or within their ownership structures.

The local foreign subsidiaries' own innovation activity ($FDI^{P^{FO}}_{rcst-1}$) shows a weaker relationship with domestic firm patenting, since the coefficient is positive but insignificant in all specifications. This indicates that either spill-overs from foreign subsidiaries' local R&D activities are overshadowed by knowledge produced at higher tiers of the multinational network, or that these firms tend to protect their innovations within corporate boundaries, as they are in direct competition with domestic firms-thus preventing knowledge from spilling over into the local market.

Additionally, the number of patents produced by other domestic firms in the same industry and region ($P^{Domestic}_{rcst-1}$) is consistently negative and becomes significant in specifications (7), (9) and (11) when we control for the innovation produced by the parent companies of the local subsidiaries. This suggests that domestic firms may compete for innovation leadership in the same regional industry, with intense local patenting activity by peers potentially crowding out individual firm-level efforts – likely due to competitive pressures, knowledge redundancy or innovation races within the same regional sector.

The limited impact of M&A and greenfield investments at the firm level further supports the interpretation that such forms of FDI primarily contribute to shaping the general innovation infrastructure rather than producing firm-specific spill-over effects. The absence of significant coefficients for these variables may also reflect the more significant influence of firm-level fixed effects, which capture unobserved characteristics (e.g. size, innovation capacity and historical performance) that are correlated with firms' exposure to broader FDI trends.

Among the control variables, the labour productivity of a firm shows a positive and significant association with domestic firm innovation, particularly when FDI is captured through deep structural measures. In contrast, the capital-to-labour ratio of firm exhibits a negative relationship, suggesting that more capital-intensive firms are less likely to engage in patenting activities, potentially reflecting sectoral differences in innovation intensity.

Notably, the coefficients of TBTs imposed by the EU and its individual member states are consistently negative and significant, indicating that increased regulatory complexity may hinder innovation by raising compliance costs and steering resources away from technological innovation. On the other hand, GDP per capita – a common proxy for market development – does not significantly affect firm-level patenting when more granular variables are controlled for.

Competition, measured via the HHI, has a negative and statistically significant coefficient, suggesting that more concentrated markets (i.e. less competition) are associated with lower innovation output. This finding aligns with the idea that competitive pressures stimulate firms to innovate in order to maintain or grow market share. Meanwhile, agglomeration externalities, captured by sector-region labour concentration, show a strong, positive and significant association with innovation, reinforcing the role of spatial clustering in fostering knowledge spill-overs and technological diffusion. This is in line with MAR localisation externalities associated with regional-sectoral knowledge spill-overs.

In Table 7, the focus shifts specifically to the sub-set of green innovation and the number of patents in green technologies owned by domestic firms. Among the various FDI channels examined, the only variable that emerges as consistently positive and statistically significant is the total assets of foreign-owned firms operating in the same regional sector. Indeed, a 1% increase in the size and financial resources of foreign subsidiaries in the previous year is associated with an increase in the number of green patents published by domestic firms by 0.0138%. This result indicates that foreign subsidiaries with substantial assets may act as important conduits for green innovation spill-overs, possibly through their integration into the local economy or the upgrading of suppliers and human capital.

By contrast, greenfield investments (columns 2-3) and M&A activity (columns 4-5) exhibit negative but statistically insignificant effects, pointing to their limited role in stimulating green innovation at the firm level. Similarly, the different measurement of technological FDI explored in columns 6-11 do not appear to be significantly correlated with green-patent production of domestic firms. In all specifications, however, the number of non-green patents owned by the domestic firm in the previous year ($P_{G',ft-1}$) displays a strong, positive and statistically significant effect. This robust finding underscores the complementarity between general and green innovation: firms that are already active in broader R&D activities are more likely to engage in green technological development. The result suggests that green innovation builds on a firm's existing knowledge base and R&D capacity, reinforcing the importance of internal innovation strength in supporting environmental transitions.

Table 8 further explores the role of technological spill-overs into green innovation of domestic firms by distinguishing between green and non-green patenting activities by foreign subsidiaries and their corporate structures. The findings reveal a pattern consistent with those observed at the regional-sector level above and underscore that the technological orientation of spill-overs via the parent of foreign-owned subsidiaries are a key driver. Notably, the number of patents published by foreign-owned local subsidiaries, whether green or non-green, shows no significant effect on the green patenting of domestic firms.

However, the green patenting activities of both the parent and the broader corporate group to which the local subsidiaries belong (excluding the subsidiaries themselves) exhibit a strong, positive and statistically significant correlation with domestic green innovation. The magnitude of the coefficients for the parent's corporate group, ranging from 0.0911 to 0.109, indicates that corporate groups specialising in green technologies may generate substantial knowledge spill-overs, thereby supporting the diffusion of green innovation across the domestic economy. On the other hand, non-green innovation by the same corporate groups is associated with a negative and significant effect, suggesting that a focus on conventional technologies may crowd out or disincentivise environmentally sustainable innovation among domestic firms.

These findings point to a technological path dependency: when foreign corporate groups prioritise green technologies, they create fertile ground for local spill-overs in this direction. Conversely, a focus on traditional technologies can foster innovation trajectories that are misaligned with green objectives, thereby hindering local green innovation.

While green patenting by the parent is positively correlated with domestic green innovation and non-green patenting of the parent is negatively associated with it, these effects become statistically insignificant once the patenting activity of the broader corporate group is included in the specification. This suggests that the corporate group, rather than the global parent company alone, is the most relevant unit through which innovation spill-overs materialise.

Turning to domestic innovation dynamics, the number of green patents published by other domestic firms in the same regional sector is also positively and significantly associated with the green patenting activity of a given firm. This finding supports the existence of positive agglomeration effects and regional specialisation in green innovation, where local innovation ecosystems and peer activity foster cumulative innovation processes.

In summary, the results from Tables 7 and 8 reveal a clear technological pattern underlying the relationship between FDI and domestic green innovation. The orientation of foreign corporate groups – whether toward green or non-green technologies – plays a decisive role in shaping the direction of knowledge spill-overs. While the structural presence of financially robust foreign firms with large total assets supports domestic innovation more generally, technological spill-overs in the green domain critically depend on the specific innovation focus of these foreign actors. Moreover, the internal innovation capacity of domestic firms and the regional innovation environment emerge as key determinants of green patenting outcomes. Thus, policy makers can stimulate green innovation (i.e. the main solution to tackling global warming and environmental degradation) by attracting FDI from multinationals that are also innovative in these domains. Looking at the other control variables, the results remain consistent with those observed in Table 6.

Table 6 / PPML estimation results for the firm-level number of patents owned by domestic firms

Dep. Var. P_{ft} **FDI measure type τ:**	**(1)** FDI^{k}_{rcst-1}	**(2)** FDI^{nGF}_{rcst-1}	**(3)** FDI^{vGF}_{rcst-1}	**(4)** $FDI^{nM\&A}_{rcst-1}$	**(5)** $FDI^{vM\&A}_{rcst-1}$	**(6)** FDI^{pFO}_{rcst-1}	**(7)** $FDI^{pParent}_{rcst-1}$	**(8)** FDI^{pGroup}_{rcst-1}	**(9)** FDI^{pFO}_{rcst-1}	**(10)** FDI^{pFO}_{rcst-1}	**(11)** FDI^{pFO}_{rcst-1}
FDI^{τ}_{rcst-1}	0.0137**	0.00528	0.00402	-0.0220	-0.00363	0.0119			0.00392	0.00480	0.00192
	(0.00452)	(0.0132)	(0.00653)	(0.0157)	(0.00538)	(0.00967)			(0.00966)	(0.00978)	(0.00968)
$FDI^{pParent}_{rcst-1}$							0.0480***		0.0474***		0.0438***
							(0.00945)		(0.00969)		(0.0120)
FDI^{pGroup}_{rcst-1}								0.0377***		0.0363***	0.0134
								(0.0102)		(0.0104)	(0.0125)
$P^{Domestic}_{rcst-1}$	-0.0151	-0.0140	-0.0140	-0.0148	-0.0143	-0.0161	-0.0251*	-0.0196	-0.0256*	-0.0202	-0.0264*
	(0.0104)	(0.0105)	(0.0105)	(0.0105)	(0.0105)	(0.0109)	(0.0106)	(0.0103)	(0.0109)	(0.0107)	(0.0108)
TBT_{cst-1}	-0.0976**	-0.108**	-0.108**	-0.105**	-0.108**	-0.106**	-0.0992**	-0.100**	-0.0981**	-0.0989**	-0.0961**
	(0.0337)	(0.0340)	(0.0341)	(0.0346)	(0.0344)	(0.0336)	(0.0328)	(0.0334)	(0.0325)	(0.0332)	(0.0323)
SPS_{cst-1}	-0.181	-0.222	-0.215	-0.198	-0.215	-0.244	-0.243	-0.242	-0.250	-0.251	-0.252
	(0.193)	(0.197)	(0.194)	(0.192)	(0.198)	(0.194)	(0.188)	(0.196)	(0.186)	(0.194)	(0.186)
$Tariff_{cst-1}$	-0.0241	-0.0159	-0.0162	-0.000375	-0.00606	-0.00491	-0.0253	-0.0282	-0.0221	-0.0239	-0.0276
	(0.0925)	(0.0933)	(0.0937)	(0.0937)	(0.0954)	(0.0914)	(0.0903)	(0.0927)	(0.0887)	(0.0910)	(0.0889)
$STRI_{cst-1}$	-0.422	-0.431	-0.423	-0.419	-0.437	-0.422	-0.346	-0.413	-0.343	-0.409	-0.343
	(0.229)	(0.229)	(0.228)	(0.229)	(0.229)	(0.227)	(0.236)	(0.228)	(0.234)	(0.226)	(0.233)
$Prod_{ft-1}$	0.0333*	0.0338*	0.0342*	0.0331*	0.0330*	0.0342*	0.0344*	0.0351*	0.0346*	0.0354*	0.0350*
	(0.0160)	(0.0161)	(0.0161)	(0.0162)	(0.0162)	(0.0161)	(0.0160)	(0.0156)	(0.0160)	(0.0156)	(0.0158)
kl_{ft-1}	-0.124***	-0.116**	-0.116**	-0.116**	-0.116**	-0.117**	-0.118***	-0.118***	-0.118***	-0.118***	-0.118***
	(0.0362)	(0.0358)	(0.0359)	(0.0357)	(0.0359)	(0.0360)	(0.0355)	(0.0357)	(0.0355)	(0.0356)	(0.0354)
GDP_{rct-1}	0.376	0.431	0.433	0.488	0.470	0.439	0.358	0.460	0.355	0.455	0.366
	(0.303)	(0.313)	(0.315)	(0.316)	(0.318)	(0.317)	(0.292)	(0.319)	(0.292)	(0.318)	(0.292)
$R\&D_{rct-1}$	0.0387	0.0418	0.0420	0.0425	0.0403	0.0455	0.0480	0.0384	0.0497	0.0406	0.0476
	(0.0391)	(0.0388)	(0.0389)	(0.0398)	(0.0392)	(0.0374)	(0.0383)	(0.0383)	(0.0371)	(0.0369)	(0.0368)
Edu_{rct-1}	0.0117***	0.0128***	0.0128***	0.0132***	0.0127***	0.0128***	0.0120***	0.0135***	0.0121***	0.0135***	0.0124***
	(0.00311)	(0.00322)	(0.00319)	(0.00320)	(0.00319)	(0.00315)	(0.00307)	(0.00316)	(0.00305)	(0.00315)	(0.00306)
$Comp_{rcst-1}$	-0.000141*	-0.000144*	-0.000143*	-0.000128*	-0.000139*	-0.000147*	-0.000139*	-0.000145*	-0.000140*	-0.000146*	-0.000141*
	(0.0000598)	(0.0000604)	(0.0000602)	(0.0000620)	(0.0000604)	(0.0000598)	(0.0000599)	(0.0000596)	(0.0000598)	(0.0000595)	(0.0000597)
Agg_{rcst-1}	8.411***	8.348***	8.433***	8.528***	8.161***	8.292***	8.457***	8.022***	8.472***	8.051***	8.370***
	(2.200)	(2.209)	(2.204)	(2.256)	(2.210)	(2.228)	(2.179)	(2.191)	(2.184)	(2.198)	(2.179)
Constant	1.848	1.357	1.323	0.663	0.931	1.217	1.896	0.715	1.910	0.753	1.704
	(3.487)	(3.612)	(3.623)	(3.634)	(3.652)	(3.649)	(3.365)	(3.646)	(3.365)	(3.643)	(3.357)
No. of observations	151,838	151,838	151,838	151,838	151,838	151,838	151,838	151,838	151,838	151,838	151,838
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	494,066.68	494,506.68	494,486.55	494,407.50	494,480.53	494,458.79	493,297.42	494,119.58	493,293.24	494,112.61	493,254.98
BIC	494,205.71	494,645.71	494,625.58	494,546.53	494,619.56	494,597.81	493,436.45	494,258.61	493,442.20	494,261.57	493,413.87

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 7 / PPML estimation results for the firm-level number of green patents owned by domestic firms

Dep. Var. $P_{G,t}$ FDI measure type τ:	(1) FDI^{k}_{rcst-1}	(2) FDI^{nGF}_{rcst-1}	(3) FDI^{vGF}_{rcst-1}	(4) $FDI^{nM\&A}_{rcst-1}$	(5) $FDI^{vM\&A}_{rcst-1}$	(6) FDI^{pFO}_{rcst-1}	(7) $FDI^{pParent}_{rcst-1}$	(8) FDI^{pGroup}_{rcst-1}	(9) FDI^{pFO}_{rcst-1}	(10) FDI^{pFO}_{rcst-1}	(11) FDI^{pFO}_{rcst-1}
FDI^{τ}_{rcst-1}	0.0138***	-0.00922	-0.00289	-0.0163	-0.00849	0.0122			0.0106	0.0141	0.0129
	(0.00418)	(0.0190)	(0.00854)	(0.0208)	(0.00675)	(0.0184)			(0.0185)	(0.0184)	(0.0185)
$FDI_{rcst-1}^{pParent}$							0.0116		0.0103		0.0138
							(0.0122)		(0.0122)		(0.0119)
FDI_{rcst-1}^{pGroup}								-0.00633		-0.00939	-0.0144
								(0.0163)		(0.0162)	(0.0158)
$P^{Domestic}_{rcst-1}$	-0.0205	-0.00774	-0.00745	-0.00762	-0.00772	-0.00920	-0.00904	-0.00581	-0.0108	-0.00794	-0.00940
	(0.0182)	(0.0194)	(0.0195)	(0.0194)	(0.0195)	(0.0201)	(0.0201)	(0.0206)	(0.0204)	(0.0207)	(0.0209)
$P_{G',ft-1}$	0.277***	0.274***	0.274***	0.273***	0.274***	0.273***	0.271***	0.274***	0.272***	0.274***	0.272***
	(0.0242)	(0.0242)	(0.0241)	(0.0241)	(0.0242)	(0.0241)	(0.0242)	(0.0242)	(0.0242)	(0.0242)	(0.0243)
TBT_{cst-1}	0.0667*	0.0499	0.0501	0.0496	0.0504	0.0485	0.0475	0.0490	0.0478	0.0497	0.0495
	(0.0316)	(0.0329)	(0.0326)	(0.0326)	(0.0325)	(0.0325)	(0.0331)	(0.0329)	(0.0327)	(0.0323)	(0.0324)
SPS_{cst-1}	-0.525*	-0.616*	-0.623*	-0.587*	-0.595*	-0.641**	-0.614*	-0.615*	-0.637**	-0.646**	-0.642**
	(0.240)	(0.246)	(0.247)	(0.247)	(0.255)	(0.241)	(0.245)	(0.247)	(0.240)	(0.241)	(0.239)
$Tariff_{cst-1}$	-0.207	-0.203	-0.207	-0.198	-0.190	-0.200	-0.214	-0.207	-0.204	-0.193	-0.195
	(0.120)	(0.124)	(0.124)	(0.126)	(0.124)	(0.115)	(0.122)	(0.124)	(0.115)	(0.117)	(0.116)
$STRI_{cst-1}$	-0.194	-0.297	-0.300	-0.287	-0.298	-0.306	-0.309	-0.299	-0.312	-0.301	-0.306
	(0.332)	(0.337)	(0.337)	(0.339)	(0.338)	(0.338)	(0.339)	(0.338)	(0.340)	(0.338)	(0.341)
$Prod_{ft-1}$	-0.00503	-0.00989	-0.00998	-0.0101	-0.0107	-0.00864	-0.00964	-0.00996	-0.00881	-0.00905	-0.00949
	(0.0124)	(0.0119)	(0.0119)	(0.0119)	(0.0121)	(0.0118)	(0.0119)	(0.0119)	(0.0118)	(0.0119)	(0.0120)
kl_{ft-1}	-0.00923	0.0169	0.0173	0.0182	0.0175	0.0157	0.0175	0.0173	0.0161	0.0155	0.0160
	(0.0183)	(0.0202)	(0.0202)	(0.0203)	(0.0201)	(0.0198)	(0.0203)	(0.0202)	(0.0199)	(0.0197)	(0.0199)
GDP_{rct-1}	0.221	0.419	0.396	0.409	0.438	0.345	0.334	0.367	0.317	0.339	0.299
	(0.357)	(0.369)	(0.371)	(0.368)	(0.38)	(0.362)	(0.372)	(0.369)	(0.365)	(0.361)	(0.365)
$R\&D_{rct-1}$	0.0389	0.0344	0.0353	0.0388	0.0375	0.0411	0.0363	0.0376	0.0406	0.0441	0.045
	(0.0555)	(0.0558)	(0.056)	(0.0566)	(0.0564)	(0.0532)	(0.0559)	(0.0571)	(0.0531)	(0.0539)	(0.0536)
Edu_{rct-1}	0.0366***	0.0393***	0.0395***	0.0403***	0.0400***	0.0397***	0.0397***	0.0396***	0.0396***	0.0393***	0.0388***
	(0.00765)	(0.00777)	(0.00782)	(0.00787)	(0.00783)	(0.00782)	(0.00786)	(0.00772)	(0.00785)	(0.00774)	(0.00778)
$Comp_{rcst-1}$	0.00000163	-0.00000842	-0.00000936	0.000000813	0.000000607	-0.0000117	-0.0000158	-0.00000984	-0.000016	-0.0000103	-0.0000153
	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)	(0.000180)
Agg_{rcst-1}	6.129***	5.572***	5.629***	5.934***	5.487***	5.867***	5.909***	5.813***	5.950***	5.886***	6.009***
	(1.438)	(1.482)	(1.455)	(1.429)	(1.419)	(1.456)	(1.452)	(1.446)	(1.463)	(1.465)	(1.478)
Constant	-1.379	-3.740	-3.487	-3.720	-4.016	-2.969	-2.844	-3.132	-2.686	-2.841	-2.397
	(4.128)	(4.312)	(4.330)	(4.297)	(4.426)	(4.242)	(4.338)	(4.302)	(4.280)	(4.228)	(4.279)
No. of observations	25,176	25,176	25,176	25,176	25,176	25,176	25,176	25,176	25,176	25,176	25,176
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AIC	61,999.184	62,055.927	62,057.070	62,054.144	62,041.847	62,053.765	62,052.854	62,057.169	62,051.531	62,053.361	62,048.413
BIC	62,121.189	62,177.932	62,179.075	62,176.149	62,163.851	62,175.770	62,174.859	62,179.173	62,181.670	62,183.499	62,186.685

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

Table 8 / PPML estimation results for the firm-level number of green patents owned by domestic firms for different types and sources of innovation activities

Dep. Var. $P_{G,ft}$ Innovation activity source:	(12) FO	(13) Parents	(14) Groups	(15) FO and parents	(16) FO and groups	(17) FO, parents and groups
$FDI_{rcst-1}^{P_G^{FO}}$	0.00246			-0.000286	-0.00330	-0.00450
	(0.0149)			(0.0148)	(0.0151)	(0.0151)
$FDI_{rcst-1}^{P_{G'}^{FO}}$	0.00264			0.00000834	0.00259	0.00183
	(0.0189)			(0.0185)	(0.0185)	(0.0184)
$FDI_{rcst-1}^{P_G^{Parent}}$		0.0506**		0.0506**		0.0297
		(0.0155)		(0.0156)		(0.0157)
$FDI_{rcst-1}^{P_{G'}^{Parent}}$		-0.0366*		-0.0366*		-0.0197
		(0.0168)		(0.0169)		(0.0166)
$FDI_{rcst-1}^{P_G^{Group}}$			0.103***		0.104***	0.0911***
			(0.0183)		(0.0180)	(0.0190)
$FDI_{rcst-1}^{P_{G'}^{Group}}$			-0.0937***		-0.0948***	-0.0882***
			(0.0183)		(0.0186)	(0.0184)
$P_{G,rcst-1}^{Domestic}$	0.274***	0.275***	0.275***	0.275***	0.275***	0.276***
	(0.0241)	(0.0241)	(0.0241)	(0.0241)	(0.0241)	(0.0241)
$P_{G',rcst-1}^{Domestic}$	0.00182	-0.00339	-0.00519	-0.00341	-0.00536	-0.00780
	(0.0145)	(0.0145)	(0.0143)	(0.0143)	(0.0142)	(0.0141)
$P_{G',ft-1}$	-0.00772	-0.00462	0.00414	-0.00454	0.00477	0.00588
	(0.0180)	(0.0176)	(0.0184)	(0.0179)	(0.0185)	(0.0185)
TBT_{cst-1}	0.0481	0.0441	0.0540	0.0441	0.0537	0.0514
	(0.0332)	(0.0332)	(0.0322)	(0.0331)	(0.0320)	(0.0321)
SPS_{cst-1}	-0.626*	-0.628*	-0.652**	-0.627**	-0.644**	-0.643**
	(0.243)	(0.247)	(0.246)	(0.243)	(0.241)	(0.239)
$Tariff_{cst-1}$	-0.208	-0.209	-0.159	-0.209	-0.159	-0.163
	(0.119)	(0.121)	(0.123)	(0.117)	(0.118)	(0.117)
$STRI_{cst-1}$	-0.307	-0.326	-0.279	-0.325	-0.274	-0.286
	(0.339)	(0.333)	(0.333)	(0.333)	(0.333)	(0.331)
$Prod_{ft-1}$	-0.00929	-0.00968	-0.0117	-0.00968	-0.0116	-0.0118
	(0.0118)	(0.0116)	(0.0120)	(0.0115)	(0.0119)	(0.0117)
kl_{ft-1}	0.0164	0.0157	0.0123	0.0157	0.0119	0.0119
	(0.0201)	(0.0198)	(0.0194)	(0.0195)	(0.0191)	(0.0189)
GDP_{rct-1}	0.366	0.387	0.461	0.386	0.449	0.442
	(0.365)	(0.371)	(0.366)	(0.367)	(0.36)	(0.365)
$R\&D_{rct-1}$	0.0379	0.0393	0.0466	0.0392	0.0464	0.0474
	(0.0543)	(0.0549)	(0.0556)	(0.0534)	(0.0536)	(0.0531)
Edu_{rct-1}	0.0398***	0.0383***	0.0372***	0.0383***	0.0373***	0.0365***
	(0.00781)	(0.00779)	(0.00755)	(0.00775)	(0.00758)	(0.00758)
$Comp_{rcst-1}$	-0.0000104	0.00000248	-0.0000144	0.00000253	-0.000014	-0.00000639
	(0.000180)	(0.000180)	(0.000177)	(0.000180)	(0.000177)	(0.000178)
Agg_{rcst-1}	5.780***	5.803***	5.413***	5.806***	5.480***	5.563***
	(1.497)	(1.482)	(1.452)	(1.517)	(1.503)	(1.534)
Constant	-3.181	-3.377	-4.132	-3.370	-3.990	-3.866
	(4.282)	(4.324)	(4.256)	(4.300)	(4.208)	(4.265)
No. of observations	25,176	25,176	25,176	25,176	25,176	25,176
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
AIC	62,062.02	62,009.23	61,913.60	62,013.23	61,916.92	61,904.64
BIC	62,200.29	62,147.50	62,051.87	62,167.77	62,071.46	62,075.44

Robust standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01.

9. Conclusions

Our empirical analysis provides robust evidence that FDI enhances domestic innovation primarily through the technological capabilities of foreign investors rather than through their mere financial presence and via their subsidiaries. While financially robust foreign subsidiaries contribute to innovation infrastructure, only those with strong technological portfolios – especially at the parent or corporate-group level – generate meaningful knowledge spill-overs to local firms and regions.

Green innovation, in particular, is closely linked to the technological specialisation of foreign MNEs rather than MNE subsidiaries. The parent groups of foreign-owned firms that specialise in green technologies significantly boost green patenting of domestic firms in proximity of subsidiaries of those MNE parents. Conversely, parent groups focused on non-green innovation are negatively associated with domestic green innovation, highlighting a path-dependency in technological spill-overs. Moreover, the presence of green innovation by domestic peers in a region reinforces individual firm-level green patenting, underscoring the importance of regional ecosystems.

To stimulate green innovation in the EU, policy makers should design investment-promotion strategies that specifically target foreign MNEs with a proven track record in green technologies. They should also facilitate the deeper integration of these MNEs into local innovation ecosystems by promoting collaboration with domestic firms. Furthermore, investment screening mechanisms should take into account not only the investing subsidiary but also the broader corporate group's technological orientation. To enhance absorptive capacity, policy makers must strengthen the innovation readiness of domestic firms through support for R&D, human-capital development and clustering policies. To incentivise green FDI, the EU should offer targeted measures, such as fast-track permitting, tax credits, and funding for joint R&D initiatives in green technologies. Collectively, these policies can help to transform FDI into a strategic lever for advancing both technological progress and environmental sustainability in Europe.

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Appendix A / Glossary

Table A1 / Definition of variables

Variable	Definition
$\boldsymbol{Agg_{rcst-1}}$	Agglomeration of labour in a regional sector relative to the region's total employment in year $\mathrm{t}-1$.
$\boldsymbol{Comp_{rcst-1}}$	Competition measure computed as the HHI index based on labour, in region r of country c, sector s in year $\mathrm{t}-1$.
$\boldsymbol{Edu_{rct-1}}$	Share of individuals with tertiary education in country c, region r, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{nGF}_{rcst-1}}$	Number of foreign greenfield projects in region r in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{vGF}_{rcst-1}}$	Value of foreign greenfield projects in region r in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{k}_{rcst-1}}$	Total assets of foreign-owned firms in region r in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{nM\&A}_{rcst-1}}$	Number of merger and acquisition (M&A) deals in region r in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{vM\&A}_{rcst-1}}$	Value of merger and acquisition (M&A) deals in region r in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{FO}}_{rcst-1}}$	Patents of foreign-owned firms with publication date in region r in country c, sector s , year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{FO}_{G}}_{rcst-1}}$	Green patents of foreign-owned firms in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{FO}_{G'}}_{rcst-1}}$	Non-green patents of foreign-owned firms in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Parent}}_{rcst-1}}$	Patents of the ultimate parents of foreign-owned firms in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Parent}_{G}}_{rcst-1}}$	Green patents of ultimate parents of foreign-owned firms in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Parent}_{G'}}_{rcst-1}}$	Non-green patents of ultimate parents of foreign-owned firms in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Group}}_{rcst-1}}$	Patents of the group of foreign-owned firms in region r in country c, sector s (excluding the foreign-owned firms and the ultimate parent), with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Group}_{G}}_{rcst-1}}$	Green patents of group of foreign-owned firms in region r in country c, sector s (excluding the foreign-owned firms and the ultimate parent), with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{P^{Group}_{G'}}_{rcst-1}}$	Non-green patents of group of foreign-owned firms in region r in country c, sector s (excluding the foreign-owned firms and the ultimate parent), with publication date in year $\mathrm{t}-1$.
$\boldsymbol{FDI^{\tau}_{rcst-1}}$	FDI measure of type τ in country c, sector s, year $\mathrm{t}-1$.
$\boldsymbol{GDP_{rct-1}}$	Total GDP produced in region r of country c in year $\mathrm{t}-1$.
$\boldsymbol{kl_{ft-1}}$	Capital-to-labour ratio for firm $\boldsymbol{f}$ in year $\mathrm{t}-1$.
$\boldsymbol{kl_{rcst-1}}$	Average capital-to-labour ratio in region r of country c, sector s, in year $\mathrm{t}-1$.
$\boldsymbol{P_{ft}}$	Number of patents published by firm f with publication date in year t.
$\boldsymbol{P_{G,ft}}$	Number of green patents published by firm f with publication date in year t.
$\boldsymbol{P_{G',ft}}$	Number of non-green patents published by firm f lwith publication date in year t.
$\boldsymbol{P_{G',ft-1}}$	Non-green patents by the domestic firm f, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{P_{rcst}}$	Number of patents published in region r in country c, sector s, with publication date in year t
$\boldsymbol{P_{G,rcst}}$	Number of green patents published in region r in country c, sector s, with publication date in year t
$\boldsymbol{P_{G',rcst}}$	Number of non-green patents published in region r in country c, sector s, with publication date in year t
$\boldsymbol{P_{G',rcst-1}}$	Non-green patents by domestic firms, in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{P^{Domestic}_{rcst-1}}$	Patents of domestic firms different from $\boldsymbol{f}$ in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{P^{Domestic}_{G,rcst-1}}$	Green patents of domestic firms different from $\boldsymbol{f}$ in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{P^{Domestic}_{G',rcst-1}}$	Non-green patents of domestic firms different from $\boldsymbol{f}$ in region r in country c, sector s, with publication date in year $\mathrm{t}-1$.
$\boldsymbol{Prod_{ft-1}}$	Productivity of firm $\boldsymbol{f}$ in year $\mathrm{t}-1$ – log (operating revenues/number of employees)
$\boldsymbol{Prod_{rcst-1}}$	Average productivity of firms in region r of country c, sector s, in year $\mathrm{t}-1$ – log (operating revenues/number of employees)
$\boldsymbol{R\&D_{rct-1}}$	Total R&D expenditure (both public and private) in region r of country c in year $\mathrm{t}-1$.
$\boldsymbol{SPS_{cst-1}}$	Average number of SPS measures imposed by country c on sector s in year $\mathrm{t}-1$.
$\boldsymbol{STRI_{cst-1}}$	Services restrictive trade index imposed by country c on sector s in year $\mathrm{t}-1$.
$\boldsymbol{Tariff_{cst-1}}$	Average tariffs imposed by country c on sector s in year $\mathrm{t}-1$.
$\boldsymbol{TBT_{cst-1}}$	Average number of TBTs imposed by country c on sector s in year $\mathrm{t}-1$.

Appendix B / Regional Distribution of FDI

Note: Comprehensive tables detailing the NACE Rev. 2 industry- and year-specific distribution of FDI across NUTS 2 (version 2016) regions for the 2013-2018 period will be made available in an online appendix upon the paper's publication.

Table B1 / FDI regional distribution for Austria – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
AT11	3.83	4.72	0.33	30.25	2,059.74	4.50	0	0.02	0.01	2.08	0.31
AT12	7.5	59.49	3.83	86.94	39,955.80	440.67	26.67	38.47	2.53	127.88	11.13
AT13	28	195.45	21.00	2,820.43	227,434.70	704.33	30.00	56.59	5.65	189.58	16.99
AT21	2	51.86	2.67	2.61	6,272.41	658.50	82.33	3.28	0.08	117.58	5.08
AT22	4	24.01	4.67	228.81	21,461.95	465.33	34.00	24.51	4.17	82.30	11.22
AT31	6.33	41.83	6.17	417.84	28,552.93	579.67	55.00	33.49	4.36	418.71	27.34
AT32	3.17	8.25	2.33	29.49	30,596.70	149.17	5.67	38.70	1.70	103.50	5.85
AT33	4.67	32.42	2.33	55.17	10,521.91	172.67	14.83	14.34	3.17	37.94	7.56
AT34	2.33	91.89	1.17	0	4,921.17	189.00	2.17	0.29	0.02	7.74	0.79

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B2 / FDI regional distribution for Belgium – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BE10	21.83	283.18	17.50	861.78	392,036.90	600.33	34.67	27.03	4.69	74.92	12.61
BE21	10.50	308.93	15.50	316.18	226,322.50	1403.50	36.50	16.98	1.31	186.51	9.12
BE22	7.50	229.02	3.17	169.58	17,625.35	155.67	30.33	5.11	0.21	117.28	5.32
BE23	14.17	205.28	14.33	1,947.34	56,167.81	443.67	13	4.42	0.16	138.16	5.74
BE24	9.67	165.45	11.83	2,392.27	156,397.10	532.17	7.83	37.79	5.28	124.82	12.77
BE25	8.67	133.94	8.33	165.29	28,971.75	459.17	18.50	7.97	0.75	23.56	1.82
BE31	2.17	124.72	4.33	58.29	51,819.69	864.00	29.33	22.07	0.52	59.24	2.01
BE32	3.00	64.26	2.50	187.12	14,998.92	439.67	15.67	3.59	0.55	24.26	3.10
BE33	5.83	66.65	4.17	153.43	10,141.37	352.00	86.50	4.38	0.22	23.26	2.73
BE34	0.83	53.30	0	0	1,092.62	85.50	0	0.02	0	1.22	0.22
BE35	1.67	7.13	0.67	0.97	2,712.16	12.83	0	0.17	0.01	0.56	0.03

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B3 / FDI regional distribution for Bulgaria – yearly average 2013-2018

	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
NUTS 2 region	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BG31	1.17	34.95	2.17	0.03	812.66	0.50	0	0.29	0	1.14	0
BG32	0.33	1.20	5.50	1.07	1,096.27	0.50	0	0	0	0.01	0
BG33	1.83	19.27	8.33	2.93	2,073.69	2.00	0	0.13	0	0.82	0.01
BG34	1.33	5.23	10.17	216.00	4,905.57	1.17	0	0	0	0.12	0
BG41	14.33	163.01	103.17	424.47	26,586.59	4.67	0	0.59	0	2.38	0.01
BG42	2.33	13.22	10.83	3.17	2,389.64	3.50	0.17	0	0	0.73	0.07

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B4 / FDI regional distribution for the Czechia – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CZ01	17.83	146.64	104.50	1,228.68	76,498.66	53.83	6.67	34.46	2.29	100.22	7.68
CZ02	8.67	155.41	4.67	43.16	23,693.80	109.00	3.83	0.74	0.16	17.88	3.07
CZ03	9.00	200.84	3.33	1,413.19	11,348.61	24.67	5.00	4.37	0.53	11.40	1.33
CZ04	5.00	172.24	3.50	0	13,731.77	33.17	1.33	1.30	0.10	4.23	0.28
CZ05	10.83	178.19	5.17	52.32	13,802.82	96.00	2.00	10.91	1.57	33.82	4.16
CZ06	10.67	120.96	13.83	31.52	17,332.57	41.17	2.33	3.12	0.13	214.33	9.15
CZ07	3.33	53.88	3.50	45.72	8,099.02	43.00	0.33	0.75	0.03	8.70	1.19
CZ08	8.17	210.55	11.00	53.51	14,309.67	63.33	0.67	0.67	0.05	5.18	0.25

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B5 / FDI regional distribution for Germany – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DE11	226.83	2,920.88	20.00	2,774.04	77,425.67	1,949.00	171.67	70.74	4.95	884.26	64.67
DE12	145.17	1,652.31	14.50	402.38	65,450.96	1,510.83	65.00	85.41	11.43	319.05	34.08
DE13	161.67	1,920.24	10.83	476.91	40,645.10	1,097.50	99.67	31.03	3.87	126.96	12.08
DE14	77.83	939.43	6.67	797.32	34,985.65	1,468.00	147.00	11.33	0.64	259.54	13.65
DE21	187.67	1,946.77	42.67	8,186.72	177,021.70	4,679.67	301.33	253.12	15.7	953.35	65.66
DE22	6.00	79.84	3.33	6.94	4,832.39	120.33	14.33	5.10	1.59	44.55	6.60
DE23	9.00	216.1.	3.00	118.67	5,864.23	1,869.17	81.83	3.22	0.21	28.34	2.46
DE24	2.67	15.45	3.00	104.05	19,193.33	434.17	52.33	26.62	5.29	79.58	13.22
DE25	16.33	167.22	7.00	1,156.29	17,720.70	694.33	75.50	20.73	2.02	125.88	12.80
DE26	9.17	237.45	4.00	305.11	16,719.92	486.83	21.83	36.99	3.09	220.49	13.49
DE27	11.5	384.08	6.67	736.62	32,342.24	1,118.17	110.67	42.27	3.87	465.60	31.81
DE30	89.83	874.77	32.17	1,839.88	126,053.90	1,042.67	120.00	52.11	4.68	188.03	16.84
DE40	14	461.06	3.83	952.24	21,500.49	575.83	147.83	8.25	0.96	148.68	10.14
DE50	38.17	294.06	2.33	6.29	14,558.47	230.17	5.67	1.38	0.08	14.50	1.99
DE60	59.83	1,286.83	21.00	1,358.61	149,798.30	1,800.50	403.33	62.93	7.27	187.53	22.37
DE71	138.67	2,495.88	30.83	2,882.89	260,399.60	4,158.17	182.33	231.13	23.07	652.03	63.14
DE72	4.33	150.13	2.50	68.86	36,383.66	342.33	3.83	27.68	1.34	89.84	6.47
DE73	1.33	41.93	3.67	64.84	9,097.92	113.67	11.83	8.50	0.87	129.24	6.44
DE80	4.17	89.2	2.33	53.78	4,980.66	61.50	2.50	4.03	0.38	18.84	1.21
DE91	11.17	333.56	3.00	611.33	28,995.37	174.50	8.83	5.90	0.34	378.62	23.92
DE92	28.83	403.56	6.67	257.78	28,939.07	325.67	22.33	24.07	2.12	299.76	27.31
DE93	8.5	216.86	2.50	13.50	12,429.72	125.50	2.83	30.66	1.90	93.14	7.04
DE94	9.17	138.23	4.67	133.70	15,144.26	158.67	13.00	17.28	3.04	309.68	19.69
DEA1	253.83	1,899.2	26.00	3,481.67	274,540.20	2,035.67	143.00	141.27	13.96	921.48	59.25
DEA2	98.83	1,362.2	17.50	1,889.70	85,438.53	1,409.00	78.33	67.23	9.53	571.90	45.86
DEA3	18.17	103.68	7.00	336.43	19,080.33	223.67	15.00	12.73	1.36	147.54	9.26
DEA4	13	125.21	6.00	390.06	18,485.18	666.67	58.00	15.63	1.81	141.98	11.65
DEA5	33.67	466.93	12.00	605.31	28,607.03	837.33	115.00	47.49	6.10	437.21	28.93
DEB1	11	145.02	3.50	776.64	16,428.22	277.00	6.50	8.07	0.64	57.22	5.87
DEB2	7.5	49.56	1.00	2.33	4,371.45	75.67	1.67	1.97	0.06	12.63	0.84
DEB3	10.83	236.52	6.50	549.56	13,576.54	343.50	44.83	48.52	4.32	233.06	19.00
DEC0	2.67	38.05	2.17	19.65	4,855.59	109.50	13.33	2.40	0.18	141.80	7.02
DED2	18.5	298.59	4.00	177.17	10,574.22	358.17	59.50	25.46	2.02	314.89	17.98
DED4	4.67	95.02	2.50	1.67	7,255.95	104.33	12.50	15.20	2.28	202.79	13.35
DED5	10.83	47.99	2.00	53.40	4,172.13	73.83	3.33	3.15	0.11	22.79	1.72
DEE0	22.33	528.46	3.50	109.07	16,612.54	124.50	34.00	4.27	0.31	23.61	1.89
DEF0	22.33	415.43	9.83	738.99	21,900.93	443.00	70.83	11.67	4.24	179.07	16.25
DEG0	24	513.26	5.83	236.42	6,287.15	314.17	33.83	22.62	2.13	110.91	9.58

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B6 / FDI regional distribution for Denmark – yearly average 2013-2018

	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
NUTS 2 region	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DK01	71.33	580.4	44.50	2,818.59	174,716.70	658.33	35.00	50.78	3.95	173.81	12.47
DK02	5	96.78	4.67	52.51	6,255.07	30.83	0.17	1.92	0.09	11.32	0.67
DK03	7.5	44.09	12.33	561.01	12,545.05	228.00	101.83	15.54	4.04	45.59	10.34
DK04	8.83	72.89	18.5	654.77	14,335.52	218.17	51.83	20.31	2.20	59.31	5.97
DK05	3.67	60.49	5.00	250.35	5,765.24	32.67	1.00	1.43	0.04	8.67	0.30

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B7 / FDI regional distribution for Finland – yearly average 2013-2018

	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
NUTS 2 region	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
FI19	2.50	63.03	13.33	623.69	8,630.10	361.33	37.50	41.67	1.97	112.94	6.60
FI1B	60.67	557.55	48.00	2,716.49	100,979.70	1,070.33	96.33	140.75	17.25	406.15	44.06
FI1C	5.33	165.78	6.83	30.03	9,512.86	207.50	17.83	4.24	0.84	30.36	3.11
FI1D	1.50	32.82	6.67	181.71	8,930.91	189.33	7.83	11.34	0.69	29.08	1.88
FI20	0	0	0	0	38.43	0	0	0	0	0	0
FI19	2.50	63.03	13.33	623.69	8,630.10	361.33	37.50	41.67	1.97	112.94	6.60

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B8 / FDI regional distribution for France – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
FR10	230.00	2,040.74	101.00	22,948.3	1,011,215,00	9,875.33	808.00	407.49	33.95	1,867.36	161.59
FRB0	7.83	121.83	2.50	10.06	12,907.70	205.83	8.00	5.18	0.42	56.92	7.33
FRC1	4.67	123.99	2.00	28.08	9,458.12	146.50	4.17	15.63	2.37	58.76	6.62
FRC2	1.33	1.45	0.67	2.50	6,622.93	171.67	8.67	24.72	4.27	73.88	11.51
FRD1	4.67	17.55	1.83	5.73	3,913.23	39.00	0.33	0.02	0	1.51	0.17
FRD2	7.17	153.94	2.33	22.67	12,306.85	602.33	6.33	9.12	2.05	36.85	6.23
FRE1	19.83	149.87	6.83	722.54	36,281.64	76.50	4.17	2.73	0.25	22.84	2.70
FRE2	5.67	121.82	2.17	216.01	13,422.29	89.17	2.33	10.68	0.51	36.99	2.62
FRF1	11.17	194.74	2.67	8.82	26,243.15	306.5	19.17	34.46	3.45	98.59	9.56
FRF2	4.00	41.33	1.67	58.63	6,152.67	98.00	3.83	0.57	0.02	10.41	0.55
FRF3	10.67	64.09	3.00	29.08	12,201.60	73.33	4.50	24.95	2.41	72.2	6.82
FRG0	11.83	116.83	6.50	205.32	19,298.05	159.67	4.17	7.65	0.87	48.86	6.30
FRH0	9.83	126.61	5.67	333.88	9,785.95	94.67	2.83	21.76	0.62	64.12	2.84
FRI1	20.83	273.48	3.83	419.54	16,750.72	102.00	2.17	6.84	0.48	24.35	2.14
FRI2	0	0	0.50	0	1,297.98	5.33	0	0.10	0.02	7.40	0.99
FRI3	1.17	64.36	1.67	11.47	7,279.03	134.17	7.33	2.96	0.03	118.39	5.45
FRJ1	9.50	102.47	2.67	44.89	12,620.66	45.33	1.00	4.80	0.41	22.22	2.43
FRJ2	9.50	147.91	4.67	314.74	96,306.44	1,815.00	295.83	13.38	3.67	84.26	16.19
FRK1	2.00	24.20	1.50	18.08	2,697.52	30.00	0.50	15.15	2.64	43.3	6.83
FRK2	42.00	535.50	21.50	2269.95	112,992.90	2,273.50	104.17	67.86	6.29	541.48	42.00
FRL0	34.17	243.82	11.17	737.23	47,395.32	888.00	41.83	26.26	0.81	199.71	10.05
FRM0	0.33	0.4	0	0	36.15	0	0	0	0	0	0
FRY1	0	0	0.17	0	84.92	0	0	0	0	0	0
FRY2	0	0	0	0	124.05	0	0	0	0	0	0
FRY3	0	0	0	0	0.06	0	0	0	0	0	0
FRY4	0	0	0	0	581.28	0	0	0	0	0.01	0

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B9 / FDI regional distribution for Greece – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
EL30	0	0	3.83	235.4	14,847.86	133.5	0.5	0.17	0.01	0.91	0.05
EL43	0	0	0	0	224.81	0	0	0.01	0	0.02	0
EL52	0	0	0.17	0	266.97	0	0	0	0	0.01	0
EL61	0	0	0	0	78.44	0	0	0	0	0	0
EL63	0	0	0	0	0.65	0.5	0	0	0	0.01	0
EL64	0	0	0	0	1,378.85	1.5	0	0.01	0	0.03	0

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands. Please note that data are missing for some regions (EL41, EL42, EL51, EL53, EL54, EL62, EL65), as we were unable to retrieve reliable information for these cases.

Table B10 / FDI regional distribution for Spain – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ES11	8.50	45.03	3.67	208.54	79,220.75	63.33	19.17	1.26	0.30	207.86	9.53
ES12	3.67	57.07	2.00	250.75	36,805.65	60.33	13.83	1.93	0.15	12.20	1.05
ES13	1.67	6.79	0.83	416.67	3,036.33	6.00	0.50	0.00	0.00	0.20	0.02
ES21	18.67	230.80	11.67	1,093.43	55,864.19	226.00	13.00	16.94	1.98	50.36	7.30
ES22	3.33	85.87	2.50	253.43	11,624.15	180.33	116.17	2.20	0.12	19.21	2.43
ES23	1.50	59.30	1.33	0.00	1,106.76	2.83	0.17	0.01	0.00	0.07	0.00
ES24	8.00	60.50	3.67	136.11	9,722.25	214.17	33.00	0.31	0.01	26.91	4.32
ES30	134.00	1,327.48	77.83	14,471.66	756,500.20	586.83	88.50	151.33	11.24	759.66	50.63
ES41	7.33	329.95	2.83	87.74	14,705.77	30.67	0.50	1.07	0.10	10.49	0.65
ES42	6.83	241.95	2.33	0.15	5,930.22	11.50	2.17	0.03	0.00	6.61	1.34
ES43	1.00	1.20	0.33	1.67	2,363.10	0.00	0.00	0.00	0.00	0.03	0.01
ES51	165.00	2,571.43	52.67	3,148.97	142,257.80	626.00	63.33	178.79	15.55	447.52	39.22
ES52	31.50	290.69	13.33	521.73	31,630.47	85.67	7.50	2.36	0.24	9.43	0.92
ES53	8.67	68.07	0.67	7.47	13,274.43	0.83	0.33	0.01	0.00	0.03	0.00
ES61	45.33	361.60	8.33	262.57	38,439.57	23.67	4.33	0.35	0.03	6.89	1.41
ES62	6.00	34.17	2.17	252.16	4,349.73	2.50	0.00	0.04	0.00	0.55	0.03
ES63	0.00	0.00	0.00	0.00	19.08	0.00	0.00	0.00	0.00	0.00	0.00
ES64	0.00	0.00	0.00	0.00	7.87	0.00	0.00	0.00	0.00	0.00	0.00
ES70	12.83	62.07	2.50	254.47	5,902.59	0.00	0.00	0.00	0.00	0.05	0.00

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B11 / FDI regional distribution for Croatia – yearly average 2013-2018

NUTS 2 region	Greenfield investments: Number (1)	Greenfield investments: Value (in EUR m) (2)	M&A activities: Number (3)	M&A activities: Value (in EUR m) (4)	Total assets of foreign subsidiaries: Value (in EUR m) (5)	Foreign subsidiaries innovation: Total patents (6)	Foreign subsidiaries innovation: Green patents (7)	Ultimate parent innovation: Total patents (in thsd.) (8)	Ultimate parent innovation: Green patents (in thsd.) (9)	Group innovation: Total patents (in thsd.) (10)	Group innovation: Green patents (in thsd.) (11)
HR03	6.33	7.97	2.00	223.10	4,913.13	0.83	0	0	0	0.95	0
HR04	13.00	53.90	5.33	169.66	15,072.04	11.33	0	0.29	0	1.18	0.01

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B12 / FDI regional distribution for Hungary – yearly average 2013-2018

NUTS 2 region	Greenfield investments: Number (1)	Greenfield investments: Value (in EUR m) (2)	M&A activities: Number (3)	M&A activities: Value (in EUR m) (4)	Total assets of foreign subsidiaries: Value (in EUR m) (5)	Foreign subsidiaries innovation: Total patents (6)	Foreign subsidiaries innovation: Green patents (7)	Ultimate parent innovation: Total patents (in thsd.) (8)	Ultimate parent innovation: Green patents (in thsd.) (9)	Group innovation: Total patents (in thsd.) (10)	Group innovation: Green patents (in thsd.) (11)
HU11	26.33	457.34	11.83	257.61	82425.73	83.50	0	32.72	5.06	82.55	11.81
HU12	8.17	77.34	1.33	53.25	15418.60	3.83	0	0.65	0.15	1.42	0.32
HU21	5.67	197.22	1.17	50.33	5991.39	4.33	0.83	0.01	0.01	2.41	0.05
HU22	5.33	148.13	0.17	0	15857.37	1.50	0.17	0.01	0	8.67	1.95
HU23	3.00	37.76	0.67	0.10	1770.54	8.67	1.33	0.02	0	0.39	0.06
HU31	7.50	374.47	0.67	2.50	4500.18	0.83	0	0.15	0.01	0.36	0.02
HU32	5.50	117.41	0.67	0.80	10635.01	0.33	0	33.31	1.23	78.99	2.91
HU33	2.83	94.41	0.83	11.33	3114.82	6.67	0	0.12	0.01	5.74	1.14

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B13 / FDI regional distribution for Ireland – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
IE04	0.33	0.79	2.67	94.20	20,874.70	269.83	0.67	1.19	0.01	24.64	0.71
IE05	8.50	151.96	7.33	269.01	247,814.40	188.67	1.33	4.67	0.03	25.58	0.70
IE06	29.67	580.18	32.67	2,726.32	1,824,468.00	1,025.33	34.50	42.03	3.05	264.60	12.71

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B14 / FDI regional distribution for Italy – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ITC1	14.00	358.64	12.50	1,551.60	99,997.82	847.50	90.00	52.44	7.87	486.57	40.25
ITC2	0.00	0.00	0.17	0.00	569.55	7.17	0.00	2.06	0.06	4.56	0.13
ITC3	2.33	6.00	3.67	207.72	9,624.36	50.00	1.50	9.14	0.79	37.52	4.56
ITC4	102.83	976.94	81.00	14,217.59	669,223.90	3,479.50	273.00	183.53	17.47	778.13	71.41
ITF1	1.00	2.80	1.67	6.75	3,593.75	21.50	0.83	8.43	1.29	121.22	7.12
ITF2	0.00	0.00	0.17	0.00	38.22	0.50	0.50	0.00	0.00	0.01	0.00
ITF3	4.67	28.53	3.50	246.20	5,981.18	29.33	0.67	21.92	2.24	55.96	5.64
ITF4	6.83	85.68	0.83	0.00	2,814.83	1.33	1.33	0.03	0.00	17.80	3.16
ITF5	0.33	0.00	0.00	0.00	2,583.21	0.00	0.00	0.00	0.00	0.02	0.00
ITF6	0.67	2.40	0.17	0.00	583.65	0.00	0.00	0.01	0.00	0.03	0.00
ITG1	6.33	39.00	0.50	66.67	4,484.60	5.50	0.67	0.05	0.01	0.44	0.25
ITG2	2.33	7.60	0.83	67.01	2,725.20	6.33	0.00	0.32	0.10	0.98	0.21
ITH1	0.67	0.80	2.33	14.09	13,050.39	21.83	0.33	0.05	0.00	0.71	0.06
ITH2	2.33	83.18	0.83	29.78	6,254.49	61.50	4.17	0.06	0.00	0.97	0.13
ITH3	23.50	274.91	19.67	1,015.70	40,793.98	578.17	46.17	38.15	3.99	221.49	15.05
ITH4	3.00	5.20	5.83	118.29	19,090.10	116.33	2.67	5.14	0.36	18.23	1.36
ITH5	16.67	492.59	20.17	2,412.70	102,751.70	685.17	20.83	33.69	5.98	353.78	29.15
ITI1	16.67	212.04	10.67	236.98	65,062.67	678.50	67.83	14.58	1.03	52.23	3.31
ITI2	1.00	1.05	1.33	216.83	2,780.95	24.83	2.00	0.66	0.05	3.83	0.31
ITI3	2.17	2.73	2.67	51.62	2,312.61	81.83	2.67	1.11	0.01	4.90	0.37

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B15 / FDI regional distribution for Lithuania – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
LT01	15.33	215.55	5.83	43.10	6,150.83	25.83	0.00	0.53	0.01	3.41	0.05
LT02	11.17	162.52	2.17	5.76	4,790.54	1.00	0.00	0.02	0.00	0.06	0.00

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B16 / FDI regional distribution for the Netherlands – yearly average 2013-2018

NUTS 2 REGION	Greenfield investments: Number	Greenfield investments: Value (in EUR m)	M&A activities: Number	M&A activities: Value (in EUR m)	Total assets of foreign subsidiaries: Value (in EUR m)	Foreign subsidiaries innovation: Total patents	Foreign subsidiaries innovation: Green patents	Ultimate parent innovation: Total patents (in thsd.)	Ultimate parent innovation: Green patents (in thsd.)	Group innovation: Total patents (in thsd.)	Group innovation: Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
NL11	1.33	5.14	3.50	18.08	7,015.02	66.83	0.00	0.16	0.01	8.67	0.04
NL12	1.00	13.33	1.00	4.33	9,613.84	57.00	18.83	2.86	0.04	91.56	3.54
NL13	1.67	67.40	1.00	0.00	6,917.29	14.17	0.67	0.23	0.00	1.84	0.06
NL21	8.83	192.86	8.17	700.18	90,721.45	217.33	16.67	5.67	0.26	40.23	4.67
NL22	7.50	128.15	15.67	709.63	128,664.20	367.00	18.00	32.68	2.36	312.65	17.52
NL23	2.33	57.25	3.50	120.78	10,557.02	10.67	0.33	5.07	1.23	15.43	2.90
NL31	8.50	172.22	11.67	2,828.14	441,862.30	117.17	2.17	29.24	4.43	206.56	17.50
NL32	124.67	1,880.55	71.83	14,000.06	3,058,518.00	1,753.17	66.17	128.89	5.31	614.47	25.69
NL33	25.83	538.06	36.67	3,703.07	1,711,476.00	3,008.67	219.17	33.72	5.34	158.45	15.99
NL34	0.00	0.00	0.83	7.72	35,468.60	3.17	0.00	0.10	0.03	6.78	0.64
NL41	30.00	769.43	31.83	3,844.03	565,397.10	2,302.83	134.83	65.42	8.28	278.71	28.79
NL42	8.00	187.94	8.67	163.53	173,387.90	444.83	13.83	54.48	2.44	252.80	10.97

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B17 / FDI regional distribution for Poland – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PL21	26.83	351.71	8.67	91.27	12,455.72	53.33	1.83	0.16	0.01	116.90	5.15
PL22	31.00	596.06	11.50	145.76	27,752.56	47.67	1.67	1.11	0.10	41.96	3.22
PL41	36.67	1,060.44	9.67	857.39	33,956.18	25.00	0.83	4.74	1.63	28.52	4.40
PL42	8.67	197.45	1.83	13.58	7,955.26	1.50	0.00	0.28	0.06	3.19	0.22
PL43	6.33	64.97	0.83	3.23	3,966.24	4.33	0.00	0.20	0.02	0.55	0.04
PL51	34.33	529.62	10.83	127.00	20,472.35	26.17	0.00	19.95	0.29	52.26	1.25
PL52	2.83	122.35	1.17	4.11	3,132.16	4.83	0.00	0.12	0.03	1.64	0.14
PL61	10.83	73.29	3.00	7.20	4,283.71	9.00	0.17	0.04	0.00	7.87	0.42
PL62	3.00	11.60	1.00	5.44	2,043.47	0.83	0.00	0.00	0.00	0.09	0.00
PL63	30.17	301.86	8.00	77.03	13,893.58	35.50	0.50	0.23	0.00	13.20	0.82
PL71	33.17	459.36	4.00	67.38	8,754.57	18.67	0.00	0.29	0.01	7.20	0.35
PL72	3.67	12.10	1.50	26.59	4,866.75	0.17	0.00	0.01	0.00	3.79	0.18
PL81	18.00	83.26	1.50	18.53	2,495.34	0.17	0.00	0.09	0.01	6.77	0.34
PL82	3.67	130.60	1.17	25.33	7,865.15	20.00	0.00	1.18	0.28	10.47	1.15
PL84	6.83	61.39	0.17	0.00	825.48	3.33	0.17	0.02	0.00	0.36	0.02
PL91	68.17	582.98	77.17	1,793.82	155,120.70	56.33	1.50	70.25	6.80	213.18	17.78
PL92	8.33	14.65	1.17	34.33	4,549.83	116.83	0.17	0.32	0.02	3.73	0.17

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B18 / FDI regional distribution for Portugal – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PT11	14.00	157.00	8.67	105.27	66,061.12	85.33	0.50	0.06	0.01	7.85	1.25
PT15	0.00	0.00	0.33	33.33	191.95	0.00	0.00	0.00	0.00	0.00	0.00
PT16	4.67	108.00	3.50	79.11	10,168.12	13.67	1.00	0.08	0.02	3.45	0.28
PT17	28.17	170.16	16.50	1,472.39	231,412.50	41.50	1.50	4.91	0.22	29.61	3.73
PT18	0.50	6.96	0.50	0.00	2,896.64	2.33	0.17	7.09	1.20	17.52	2.56
PT20	0.00	0.00	0.17	0.00	297.70	0.00	0.00	0.00	0.00	0.00	0.00
PT30	0.67	0.80	0.33	0.00	5,841.01	24.67	0.17	0.22	0.02	3.24	0.20

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B19 / FDI regional distribution for Romania – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
RO11	41.67	309.41	3.17	2.08	5,585.11	3.83	0.00	0.10	0.00	0.26	0.00
RO12	31.67	82.08	2.17	53.62	8,239.81	2.83	0.00	0.00	0.00	0.11	0.00
RO21	39.67	138.32	1.50	21.58	2,477.17	1.67	0.00	0.00	0.00	0.02	0.00
RO22	32.67	97.20	1.83	44.79	3,864.50	2.83	0.00	0.00	0.00	0.02	0.00
RO31	44.67	229.28	2.00	89.60	9,258.17	3.33	0.00	0.03	0.00	2.00	0.54
RO32	124.17	543.05	20.00	358.28	74,442.61	14.50	1.33	4.13	0.35	11.40	0.78
RO41	25.17	69.75	1.83	6.00	3,346.49	0.00	0.00	0.00	0.00	0.04	0.00
RO42	42.17	160.98	1.17	0.50	6,309.82	2.67	0.00	0.01	0.00	1.71	0.19

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B20 / FDI regional distribution for Slovakia – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SK01	8.50	287.59	3.83	23.46	40,769.62	37.50	8.67	3.38	0.14	10.89	0.87
SK02	11.00	97.66	2.00	11.41	17,778.36	22.67	0.50	17.58	1.13	40.72	3.41
SK03	10.50	51.12	1.33	30.32	11,041.28	5.67	1.83	0.03	0.00	3.10	0.45
SK04	7.83	127.24	1.33	4.31	7,031.24	4.67	0.00	0.12	0.00	0.78	0.01

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B21 / FDI regional distribution for Sweden – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
SE11	32.83	245.96	58.17	5,324.79	438,356.50	3,668.83	609.50	83.08	7.59	290.76	26.46
SE12	2.17	89.32	9.17	191.11	44,798.95	604.33	12.67	64.58	11.73	191.80	31.85
SE21	2.00	13.30	3.83	23.50	11,682.30	184.33	10.33	2.57	0.23	11.58	0.87
SE22	4.33	108.67	19.00	2,081.94	108,217.20	1,324.50	46.17	124.53	4.72	313.43	11.83
SE23	11.17	125.98	24.50	937.30	69,879.89	645.17	58.83	25.80	5.49	200.99	22.03
SE31	1.83	3.65	3.33	21.47	14,395.09	104.67	1.50	7.81	0.54	29.68	2.73
SE32	0.33	0.20	1.83	26.17	5,656.91	265.17	21.83	0.84	0.04	4.54	0.27
SE33	3.83	44.40	3.33	16.92	2,387.02	83.67	0.00	1.45	0.28	15.13	2.63

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

Table B22 / FDI regional distribution for Cyprus, Estonia, Latvia, Luxembourg and Malta – yearly average 2013-2018

NUTS 2 region	Greenfield investments		M&A activities		Total assets of foreign subsidiaries	Foreign subsidiaries innovation		Ultimate parent innovation		Group innovation	
	Number	Value (in EUR m)	Number	Value (in EUR m)	Value (in EUR m)	Total patents	Green patents	Total patents (in thsd.)	Green patents (in thsd.)	Total patents (in thsd.)	Green patents (in thsd.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CY00	0.67	2.71	18.33	1,034.36	205,538.80	25.67	0.50	0.00	0.00	0.48	0.00
EE00	9.33	190.72	13.33	69.12	36,749.02	14.33	3.17	0.80	0.00	2.59	0.05
LV00	3.67	37.17	18.67	71.86	16,124.43	5.17	0.00	0.04	0.00	0.19	0.00
LU00	11.50	203.14	34.33	18,084.08	5,167,997.00	1,388.83	252.83	20.41	1.37	115.28	6.56
MT00	2.17	13.56	4.17	297.70	96,559.51	209.00	1.17	0.05	0.00	2.89	0.12

Note: The table reports the yearly average values of FDI proxies by region (NUTS 2 level, version 2016), calculated over the 2013-2018 period. Column (1) shows the average number of greenfield investments, while column (2) reports their corresponding value in millions of euros. Column (3) presents the number of M&A deals in the region, and column (4) provides their total value, also in millions of euros. Column (5) displays the value of total assets held by foreign subsidiaries in the region in millions of euros. Column (6) reports the number of patents published by these subsidiaries, while column (7) refers to green patents only. Columns (8) and (9) report, respectively, the total number of patents and green patents held by the global ultimate owners of the foreign subsidiaries expressed in thousands. Finally, columns (10) and (11) show the number of overall patents and green patents held by the multinational group of the foreign subsidiaries – excluding both the subsidiaries themselves and their global ultimate owners – also expressed in thousands.

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