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Inward FDI and regional performance in Europe after the Great Recession

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This paper looks at inward foreign direct investment (FDI) and regional labour productivity in the aftermath of the Great Recession, exploring two FDI-induced effects. The first effect is linked with a capacity of FDI *per se* to trigger short-term productivity gains in response to a global shock. The second effect is associated with the degree of industrial diversification of these investment flows. The results suggest that it is not the amount of foreign investment received *per se* that matters for productivity recovery but its composition. A low degree of FDI diversification helped regions to gain productivity after the shock. The effect is stronger in regions with an industrial profile concentrated in a limited number of sectors, particularly in services. FDI can support regional recovery, but in the short run, it does so by matching and reinforcing existing regional specialisation profiles and to the benefit of services-oriented regions.

Keywords: inward FDI, industrial profile, regional growth, European Union

JEL Classifications: C26, F2, R11, R12

Introduction

European Union (EU) labour productivity had been growing steadily over the two decades preceding the Great Recession. However, 'the financial crisis in 2009 and the COVID-19 pandemic in 2020 interrupted the previous overall growth trends of labour productivity' (Eurostat, 2022). Recovery in labour productivity remained markedly slow in Europe in the aftermath of both crises: indeed, the United States (US) 'recovered faster from both recessions and recorded faster labour productivity increases than the EU'.[1] Looking at the 2005–2022 period, while the overall change in employment was almost identical in these two large economies, US Gross Domestic Product (GDP) increased by about 10% more than EU GDP over the same period, highlighting a significant gap in productivity growth over the two shocks and the corresponding recovery phases.

Intra- and extra-EU economic integration through Foreign direct investment (FDI) has followed comparable patterns. FDI inflows into the EU reached their historical peak in 2007 (USD 0.67 trillion). They dropped dramatically with the Great Recession (USD 0.22 trillion in 2008) and recovered slowly after the shock, reaching their pre-crisis level in 2015 (USD 0.63 trillion) only to drop again following the outcome of the *Brexit* referendum in 2016 (USD 0.36 trillion).[2] Subsequently, FDI inflows have stabilised in a long-term plateau of sluggish FDI growth that has continued well after the temporary post-COVID-19 rebound.

While the macro- and micro-level determinants of Europe's sluggish labour productivity growth have been extensively discussed in the policy and scholarly literature, the link between post-crisis productivity recovery and the geography of global connectivity through FDI remains significantly under-researched. In addition, while the link between FDI inflows and labour productivity growth is well established in 'normal times', the link between FDI and labour productivity in the aftermath of a shock that results in both a contraction and slow rebound remains significantly under-researched.

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This paper aims to address this important gap in the literature by analysing specifically the short-term link between inward FDI and EU regional labour productivity growth in the aftermath of the Great Recession. Academic research has highlighted the channels through which inward FDI may impact productivity in the host economy. Research has covered factors such as the creation of new jobs, the increase in demand for domestic intermediate inputs and the diffusion of firm-specific knowledge-based assets—from new technologies to management practices (Barrell and Pain, 1997; Haaland and Wooton, 1999; Markusen and Venables, 1999; Rivera-Batiz and Rivera-Batiz, 1991; Rodríguez-Clare, 1996). However, there is still no consensus in the economic literature on the impact of inward FDI on the performance of host economies and their domestic firms, particularly following a negative global economic shock (Demena and van Bergeijk, 2017; Saurav and Kuo, 2020).

This study presents three main novelties. First, it tries to disentangle the role of FDI in post-shock productivity growth by considering two different effects: one related to the dollar value of investment inflows and a second effect associated with the degree of industrial diversification of FDI inflows. In line with previous contributions analysing the impact of FDI, the first dimension aims at assessing whether inward FDI—that is, the attraction of new foreign-owned capital in the region—impacts the host (regional) economy in the post-shock productivity recovery phase. As highlighted by Goldin et al. (2024, 196), 'a decline in the contribution of capital per worker' can be counted among the factors underlying labour productivity slowdowns in more advanced economies, including the dynamics registered by most EU countries and regions during the last decades (Rodríguez-Pose and Ganau, 2022). In this respect, new greenfield inward FDI may represent a valuable capital injection for host regions to support labour productivity growth, especially following a major negative shock. Conversely, the second dimension aims at shedding new light on what industrial profile of inward investment is more supportive of short-term regional performance in a period of crisis when regions can either leverage external knowledge acquired through inward FDI to expand activities in related sectors (e.g., Cortinovis et al., 2020) or reinforce their existing industrial structure and sectoral composition (e.g., Cainelli et al., 2019; Xiao et al., 2018). The second innovative contribution is the explicit consideration of FDI in services, given the increasing relevance of the internationalisation of this sector, which indeed accounts for the large share of FDI growth since the Great Recession (UNCTAD, 2024). Therefore, although previous work has focussed on the intra- and inter-industry dimensions of FDI externalities, this is the first attempt to identify both which industrial profile of the host region maximises the potential benefits arising from inward FDI and whether FDI benefits increase when the industrial profile of the host region and that of inward FDI are 'aligned', with a consistent focus on the services sector. Finally, the paper leverages an innovative strategy to mitigate simultaneity and reverse causality concerns when estimating the association between FDI and regional short-term performance.

The empirical analysis is performed on 159 EU regions observed over the 2008–2014 short run, post-crisis period. Overall, the results suggest that inward FDI has a positive effect on labour productivity growth and that regions benefit from receiving investment projects that are concentrated in a limited number of focal sectors. In particular, the effect related to the industrial profile of the investments is triple the 'absolute FDI size' effect. This suggests that it is not the FDI dollar value *per se* that really matters for short-term recovery, but the concentration of the inward FDI portfolio around a limited number of priority sectors. This short-run productivity effect is magnified in regions characterised by a local industrial profile also focussed on a limited number of sectors. Moreover, FDI in services plays a greater role than FDI in other sectors, but again, it is the 'alignment' between the sectoral profile of FDI and that of the region that matters. Regions already specialised in services benefit the most from FDI in services. Overall, these results suggest that FDI can support the recovery of regions, but—at least in the short run—it does so by matching and reinforcing existing regional specialisation profiles. While regional data are still insufficient to capture the geography of post-COVID-19 productivity patterns, recent survey-based firm-level evidence has indeed highlighted a link between internationalisation (captured by trade and foreign ownership) and heterogeneity in firms' economic dynamism (captured by sales) in the aftermath of the COVID-19 pandemic (Jordaan, 2023).

The rest of the paper is organised as follows. The second section presents the related literature and derives the research hypotheses to be tested empirically. The third section presents data, variables, and methods. The fourth section presents and discusses the empirical results. The fifth section concludes and develops some tentative policy considerations.

Theoretical framework

Related literature

Foreign Multinational Enterprises (MNEs) tend to outperform domestic firms in terms of productivity and innovation (Castellani and Zanfei, 2006; Criscuolo et al., 2010). Inward FDI boosts the host regions' physical capital endowment and acts as an externality-generator that enhances the productivity of domestic firms (Javorcik, 2004; Xu and Sheng, 2012). In this respect, spillovers arise from the impossibility of MNEs completely internalising their competitive advantage in terms of knowledge and technology (Markusen, 1995).

Theoretical and empirical contributions have identified intra- and inter-industry linkages as the two main interaction mechanisms between foreign and domestic firms for spillovers to materialise (Barba Navarretti and Venables, 2004). Knowledge flows through intra-industry interactions result from several channels: demonstration effects, if domestic firms are exposed to multinationals' superior technology (Castellani and Zanfei, 2003); competition effects, if domestic firms are pushed to increase internal efficiency and adopt new technologies by the presence of foreign affiliates (Wang and Blomström, 1992) and labour mobility, through the circulation of skilled workers from foreign to domestic firms (Fosfuri et al., 2001). On the contrary, inter-industry interactions arise from backward and forward linkages among vertically integrated foreign and domestic firms (Bitzer et al., 2008; Castellani and Zanfei, 2006; Javorcik, 2004).

Consequently, inward FDI is supposed to stimulate aggregate productivity (Aitken and Harrison, 1999) and, thus, economic growth both directly—that is, through the higher productivity of MNEs locating their activities in the host economy—and indirectly—that is, through spillovers benefitting domestic firms.

Along these lines, a large body of empirical contributions has investigated the role of FDI in influencing the performance of domestic firms in the host economy (e.g., Aitken and Harrison, 1999; Barrios et al., 2005; Castellani and Zanfei, 2003, 2007; Crescenzi et al., 2015; Haskel et al., 2007; Javorcik, 2004), as well as the economic performance of the host country as a whole (e.g., Alfaro et al., 2004; Bitzer et al., 2008; Borensztein et al., 1998; De Mello, 1999; Hermes and Lensink, 2010; Li and Liu, 2005; Varamini and Vu, 2007). However, the results from these research strands remain inconclusive due to differences in FDI measurement, sample analysed, period considered and estimation technique (Almfraji and Almsafir, 2014; Demena and van Bergeijk, 2017; Kumari, 2014; Saurav and Kuo, 2020; Smeets, 2008).

Relatively more recent research has also highlighted the spatially embedded nature of FDI spillovers (Girma, 2005; Mullen and Williams, 2005), thus identifying an alternative source of bias characterising previous studies at the national level. For example, as stated by Driffield (2006, 108), externalities from FDI 'are not equal for all regions of the UK, so again any attempt to estimate the effects of spillovers nationally may lead to biased results'. The regional dimension of inward FDI has received greater attention, in the light of the increasingly apparent spatial (within-country) heterogeneity in both the location choices of MNEs and in their economic impacts (e.g., Bajo-Rubio et al., 2010; Menghinello et al., 2010; Crescenzi et al., 2022; Brakman et al., 2023).

Studies on the regional dimension of FDI extend to foreign firms' spillovers the general idea that knowledge flows and technology transfer are maximised at the local level (Audretsch and Feldman, 1996), in fact, geographic proximity facilitates interactions and amplifies knowledge flows. However, as recently shown by Baum-Snow et al. (2024), positive productivity spillovers depend on the 'nature' of co-located firms and their industrial composition. In this respect, foreign firms can be regarded as 'high-quality' actors capable of generating positive externalities that benefit domestic firms—both less productive non-internationalised firms and more productive internationalised ones (Helpman et al., 2004; Melitz, 2003) —in the host region.

Following this approach, a stream of empirical research has developed to unveil the geographical and regional dimensions of FDI beyond firm boundaries and from a cross-country perspective. Among the studies with a focus on Europe, Crescenzi et al. (2014) bring together the literature on Global Value Chains (GVC) with the location choices of MNEs to show how different types of European regions are able to attract FDI at different GVC stages. They show that stronger regional innovation systems attract the most advanced and sophisticated business functions with the highest potential for positive regional innovation impacts, reinforcing a pattern of functional (rather than sectoral) agglomeration of foreign activity. Similar patterns have been identified in Central and Eastern Europe (CEE) by Dogaru et al. (2015), showing that more advanced and service-oriented capital city regions not only receive more greenfield FDI but also attract a larger variety of higher-end, higher-productivity investments in terms of sectors and functions that reinforce existing regional disparities within CEE countries. Castellani et al. (2016) take a complementary approach to the analysis of the sorting patterns of FDI into different types of regions. They analyse the determinants of inward business services FDI in Europe showing that the geography of foreign investment in the business service industry is shaped by the underlying geography of domestic manufacturing through pre-existing local intermediate demand.

If a consolidated body of research has shown the persistency and cumulative nature of regional FDI agglomeration along both functional and sectoral lines, more ambiguous is the evidence on the regional impacts of these FDI location patterns. Marelli et al. (2014) explore the inward FDI–employment nexus, showing that FDI inflows boost employment in all economic sectors, excluding construction, but these positive effects are detected only in the most advanced regions of Northern and Western Europe. Casi and Resmini (2017) look at regional FDI impacts on productivity and suggest that positive spillovers are associated with FDI in services only and that the effect is mediated by the wider socio-institutional environment of the host region. Cortinovis et al. (2020) look at all regions of Europe to show that inter-sector MNE spillovers are influenced by industrial relatedness and significantly boost employment levels. Regions with lower factor

prices benefit the most in terms of employment from multinationals, but the effects are concentrated in highly knowledge-intensive sectors. Taken together, the existing literature highlights the cumulative nature and 'stickiness' of FDI location choices, as well as their significant impact heterogeneity that depends on the characteristics of both the investment and the host economy. This suggests that in times of crises, it would be (even more) difficult for regions to adjust their inward FDI portfolio, mostly relying on FDI inflows that reflect pre-crisis investors' decisions. At the same time, the challenging economic conditions triggered by the crisis constraint the capacity of the regional eco-system to adapt and embed new FDI as it would be in 'normal' times. As a result, while the existing literature has identified positive FDI impacts in the medium to long run, short-term effects in a time of crisis might differ and present different forms of spatial and sectoral heterogeneity because of the tighter constraints for the adjustment of both FDI flows and regional absorptive capacity under crisis conditions. In addition, the literature remains silent on how the alignment (or lack thereof) between the sectoral profile of FDI flows and that of the recipient region might influence regional short-term performance under 'crisis' constraints as highlighted above.

Research questions

In order to fill the knowledge gaps highlighted above, this paper proposes to analyse the short-term economic effects of inward FDI from a dual perspective. Specifically, it investigates the effect of both the presence of foreign firms in the host regional economy and the industrial profile of inward investment.

Regions can leverage FDI to upgrade their industrial profile by promoting the entry of new activities which are more (or less) 'aligned' with the already existing local economic environment. This process can be particularly relevant in a short run, post-crisis period, during which regions need to 'bounce back' as quickly as possible. Indeed, existing literature has shown how the industrial structure and sectoral composition of a region played a key role in determining a region's resilience capacity following the Great Recession (e.g., Cainelli et al., 2019; Cuadrado-Roura and Maroto, 2016; Palaskas et al., 2015; Xiao et al., 2018). In this respect, the presence of foreign firms and a particular industrial profile characterising inward FDI can play different roles (e.g., Cortinovis et al., 2020; Lo Turco and Maggioni, 2019). First, inward FDI may contribute to and improve the local process of inter-firm knowledge exchange. In this case, two distinct forces can be in action. On the one hand, an increase in the presence of foreign firms can increase the local knowledge pool (and its diversity) in the host region, thus magnifying non-pecuniary externalities among firms and, consequently, promoting productivity growth in a turbulent environment. On the other hand, the potential for knowledge flows and technology transfer in cognitive realms immediately relevant to the local economy can be maximised in the short run by the industrial profile of inward FDI. This latter effect is likely to be contingent upon the nature of this profile and its evolution. The host region could reinforce an already existing 'sectoral hub' or move towards the development of a sectoral cluster. Alternatively, the host region could diversify the local economic structure to both exploit inter-sector externalities and magnify the portfolio effect based on industrial diversification, which protects a region from external shocks. In this last case, inward FDI—in particular, greenfield investment—represents a source of brand new resources for a region *per se*. In addition, inward FDI is likely to push the value chain reconfiguration process of the host region through the identification of the key sectoral dimensions promoting resilience and, consequently, favouring a positive short run economic performance.[3]

Therefore, two interrelated questions arise. Do host economies benefit from inward FDI in their short-run recovery? If this is the case, which industrial profile of inward FDI really matters? An 'absolute size' effect related to the amount of inward FDI is tested to answer the first research question, while an 'industrial profile' effect capturing the level of sectoral diversification among inward FDI is tested to answer the second research question.

In addition, previous contributions have emphasised several heterogeneous factors influencing the extent to which inward FDI can impact the host economy—for example, domestic firms' absorptive capacity (Borensztein et al., 1998) and the level of complementarity between foreign and domestic activities (De Mello, 1999). Moreover, differences in FDI characteristics are also likely to cause different effects of inward FDI on regional labour productivity growth.

To address this issue, two main heterogeneity sources need to be explored and tested. The first one refers to the host regions' industrial profile. This heterogeneity source is likely to be particularly meaningful in the present analysis, as it allows us to identify whether an 'optimal' matching exists between inward FDI and the host region in terms of industrial profile. For example, Hennart (2009) underlines how MNEs' entry choice is highly influenced by the host economy's industrial structure, as well as by the local levels of specialised and complementary assets. Therefore, it is expected that the effect related to the industrial profile of inward FDI is driven by the regional industrial profile, either in terms of complementarity or in terms of regional reconfiguration of the local industrial environment.

The second heterogeneity source refers to the sectoral typology of inward FDI. This dimension is analysed by separately testing the different roles played by production versus services FDI. Some recent contributions have underlined the existence of considerable differences between

services and non-services—mainly manufacturing—FDI in terms of both MNEs' location choice determinants (e.g., Casi and Resmini, 2010, 2014; Crescenzi et al., 2021; Duboz et al., 2019; Jones and Wren, 2016) and impact of inward investments on innovation (e.g., Antonietti et al., 2015), degree of economic complexity (e.g., Kannen, 2020) and economic growth (e.g., Bergougui and Murshed, 2023; Casi and Resmini, 2017; Doytch and Uctum, 2019; Haini and Tan, 2022; Inekwe, 2013). In addition, the interest in the services sector is motivated by its increasing importance in terms of MNEs' activity, as the contribution of services FDI to the world FDI stock has increased from about one-quarter in the early 1970s to about two-thirds in 2015 (UNCTAD, 2024). The growth of services FDI has interested mainly developed economies (UNCTAD, 2004), including EU member states (Castellani et al., 2016; Resmini, 2013), where services seem to represent a key driver for competitiveness and economic growth. The contribution of the services sector to total Gross Value Added (GVA) in the EU increased by 2.17% from 2003 to 2014, whereas the contribution of manufacturing to total GVA decreased by –1.47% over the same period.

In this respect, services FDI may represent a key channel to foster competition and strengthen the resilience capacity of EU regions in the era of services globalisation, which is characterised by the tendency towards the liberalisation of (traditionally monopolistic) service sectors and the increasing outsourcing of service activities that are neither storable nor tradable and need to be produced where they are consumed (Kolstad and Villanger, 2008; Resmini, 2013). Similar to production FDI, services FDI may positively impact the host economy by increasing local competition, creating jobs and promoting inter-firm externalities. However, externalities arising from services FDI are likely to diffuse to a larger extent, given that services firms are potentially connected with a greater variety of foreign and domestic activities than production FDI. In addition, services FDI is likely to sustain the shift of local economies towards the services sector and reinforce the regional industrial structure through the development of a more advanced local services sector by improving the quality of the already available services, promoting the upgrade of existing service activities and increasing the variety of the services provided through the introduction of new services in the local economy (Fernandes and Paunov, 2012).

Therefore, sectoral differences in inward FDI are explicitly modelled because they are likely to drive both the effect related to the presence of foreign capital and the effect related to the industrial profile of FDI.

Data and method

Dataset

The empirical analysis employs three main data sources: Eurostat's (Statistical Office of the European Communities) *Regio* database, which provides general economic and demographic data on the EU regions; Cambridge Econometrics' *European Regional Database*, which provides sectoral employment data and Financial Times' *fDi Markets* database, which provides information on greenfield FDI projects in terms of set up year, source and destination region, and sector at the two-digit level of the 2012 North American Industry Classification System (NAICS).[4]

The empirical analysis is performed on 159 regions covering all EU-27 countries and the UK for which regional data are available over the 2008–2014 period. The spatial unit of analysis considered varies by country, and it is chosen following the existing literature on EU regions (e.g., Crescenzi et al., 2021; Crescenzi et al., 2014; Crescenzi et al., 2007) based on the effective institutional power regional governments may have in influencing the local economic performance. Specifically, regions have been selected in order to 'maximise their homogeneity in terms of the relevant socio-institutional structure' (Crescenzi et al., 2014, 1065) and guarantee cross-country comparability in terms of regions' administrative and institutional power, such that the regions in the sample are those 'that can better "self-contain" the functional interactions between MNC subsidiaries and the "local" economy' (Crescenzi et al., 2014, 1065). Level 1 of the *Nomenclature des Unités Territoriales Statistiques* (NUTS) adopted by the EU is chosen for Belgium, Germany and the United Kingdom, while the NUTS-2 level is chosen for the remaining countries covered, that is, Austria, Czech Republic, France, Hungary, Ireland, Italy, the Netherlands, Poland, Romania, Spain and Sweden.

Table 1 presents the geographic structure of the sample and its representativeness. All regions belonging to the listed countries are covered in the sample, except for the French region of Corsica and the Spanish regions of Canary Islands, Ceuta and Melilla. Overall, the sample represents 98% of the countries analysed.

Table 2 reports the country distribution of the number of inward greenfield FDI set up over the 2008–2014 period. The UK has received 24.3% of investments, followed by Germany (18.5%). The two countries account together for 42.8% of FDI set up. Sweden and Austria are the countries that have received the lowest number of investments, that is, 1.7% and 1.9%, respectively.

Figure 1 maps the spatial distribution of the number of inward greenfield FDI projects, and it highlights the presence of two different intra-country spatial patterns. Austria, Italy, the Netherlands and Sweden present a homogeneous regional distribution of FDI, with at least 58% of regions receiving at most 50 investments, while 58% of British regions have received at least 250 investments. The remaining countries present a highly heterogeneous regional distribution: for example, the number of inward FDI in German regions ranges from 25 to 1087.

Table 1. Countries covered and sample representativeness.

Country	Regions		
	Country	Sample	Percentage covered
Austria	9	9	100.00
Belgium	3	3	100.00
Czech Republic	8	8	100.00
France	22	21	95.45
Germany	16	16	100.00
Hungary	7	7	100.00
Ireland	2	2	100.00
Italy	21	21	100.00
Netherlands	12	12	100.00
Poland	16	16	100.00
Romania	8	8	100.00
Spain	19	16	84.21
Sweden	8	8	100.00
United Kingdom (UK)	12	12	100.00
Total	163	159	97.55

Notes: Values correspond to NUTS-1 regions for Belgium, Germany and the UK, while correspond to NUTS-2 regions for the other counties. The five French Overseas Departments are excluded *à priori* from the analysis. The sample does not include the French region of Corsica and the Spanish regions of Canary Islands, Ceuta and Melilla due to data availability constraints.

Table 2. Distribution of inward greenfield FDI by country.

Country	Number of inward greenfield FDI	
	No.	%
Austria	501	1.93
Belgium	781	3.01
Czech Republic	821	3.16
France	2808	10.81
Germany	4790	18.45
Hungary	720	2.77
Ireland	1219	4.69
Italy	963	3.71
Netherlands	1044	4.02
Poland	1748	6.73
Romania	1285	4.95
Spain	2528	9.74
Sweden	441	1.70
United Kingdom (UK)	6319	24.33
Total	25,968	100.00

Notes: Percentage values are defined on column total.

Table 3 presents the sectoral distribution of inward greenfield FDI: 45% of investment projects are in production, with 39% of investment projects concentrated in manufacturing sectors (NAICS codes 31–33). The information sector (NAICS code 51) represents the most attractive one among services, accounting for 14% of inward FDI.

Empirical model

The empirical analysis aims at testing whether and to what extent brand-new inward greenfield FDI affects the economic performance of EU regions during the 2008–2014 short run, post-crisis period. The dependent variable captures the average yearly labour productivity growth defined over the 2008–2014 period as follows (Castellani and Pieri, 2016):

$$\overline{\Delta \text{labour productivity}_r} = \frac{1}{6}\left\{\sum_{t=2008}^{2013}\left[\log\left(\frac{\text{GDP}_{r,t+1}}{E_{r,t+1}}\right) - \log\left(\frac{\text{GDP}_{r,t}}{E_{r,t}}\right)\right]\right\}, \quad (1)$$

where the subscripts r and t denote the regional and temporal dimensions, respectively; the term $\text{GDP}_{r,t}$ denotes the GDP of region r at time t; the term $E_{r,t}$ denotes employment. Figure 2 maps the spatial distribution of the dependent variable. First, a negative average yearly labour productivity growth characterises only 18 regions—that is, 11.32% of the sample—which are concentrated in Hungary (6 out of 7 regions), Czech Republic (6 out of 8 regions), Italy (5 out of 21 regions) and France (the region of Franche-Comté only). Second, most countries present a highly heterogeneous regional growth distribution, while few countries—for example, Sweden and the UK—present a homogeneous distribution.

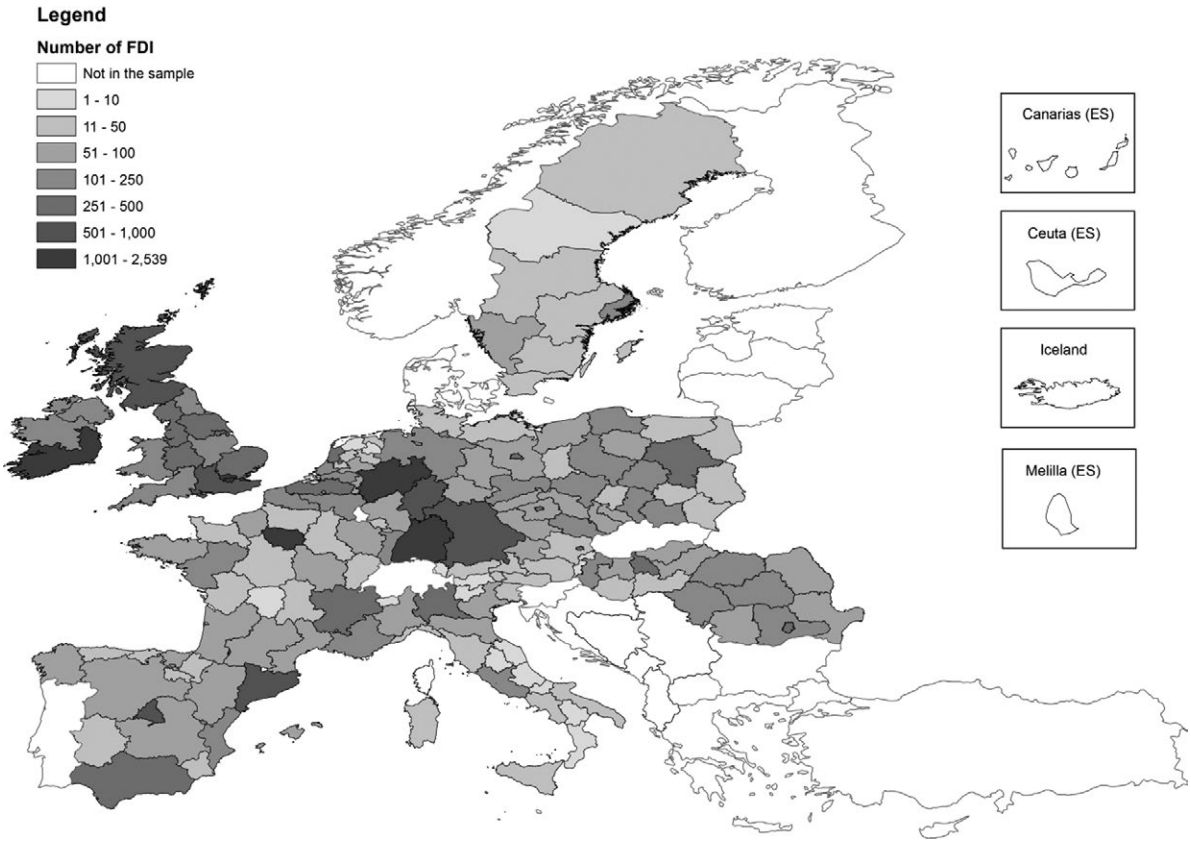

Figure 1. Spatial distribution of inward greenfield FDI. *Notes*: The distribution is based on the number of inward greenfield FDI set up over the 2008-2014 period.

The following regression equation is specified to analyse the relationship between FDI and labour productivity growth:

$$\begin{aligned}&\overline{\Delta\text{labour productivity}_r}\\&= \alpha + \beta \log(\text{FDI}_r) + \gamma \log(\text{IHHI\_FDI}_r)\\&+ \sum_{k=1}^{K} \delta_k X_r^k + \theta \log\left[\frac{\text{attractiveness}_r}{(1-\text{attractiveness}_r)}\right] + \vartheta_c + \varepsilon_r,\end{aligned} \quad (2)$$

where α is a constant term; the terms $\log(\text{FDI}_r)$ and $\log(\text{IHHI\_FDI}_r)$ are the explanatory variables of interest capturing the FDI dynamics over the 2008–2014 period; the term X_r^k denotes a vector of log-transformed region-specific controls defined at the beginning of the growth period; the term $\log[\text{attractiveness}_r/(1-\text{attractiveness}_r)]$ is a control variable capturing the pre-crisis regional attractiveness with respect to FDI; the term ϑ_c denotes a set of country dummy variables aimed at capturing socio-economic and institutional national features affecting all regions belonging to the same country and ε_r denotes the error term.[5]

The key explanatory variables are those capturing the regional dimension of inward FDI. The effect related to the amount of FDI received is captured by the number of inward investments set up in the region r during the 2008–2014 period:

$$\text{FDI}_r = \sum_{t=2008}^{2014} \text{FDI}_{r,t}, \quad (3)$$

where the term $\text{FDI}_{r,t}$ denotes the number of brand new inward greenfield FDI set up in the region r at the time $t = 2008, \ldots, 2014$.[6]

The effect related to the industrial profile of FDI is measured by the inverse of a Herfindahl–Hirschman Index (HHI) defined on the cumulative number of investments set up during the 2008–2014 period:

$$\text{IHHI\_FDI}_r = \left\{\sum_{s=1}^{S}\left[\frac{\sum_{t=2008}^{2014}\text{FDI}_{r,s,t}}{\sum_{s=1}^{S}\left(\sum_{t=2008}^{2014}\text{FDI}_{r,s,t}\right)}\right]^2\right\}^{-1}, \quad (4)$$

where the term $\text{FDI}_{r,s,t}$ denotes the number of inward greenfield FDI concerning sector $s = 1, \ldots, S$ and received by region r at time t. The HHI ranges in the interval $[1/S, 1]$ and its value increases in the level of industrial concentration. Therefore, the inverse HHI defined in Equation (4) has a value increasing in the level of industrial diversification: the

Table 3. Distribution of inward greenfield FDI by sector.

Category	Two-digit NAICS sector	Number of inward greenfield FDI	
		No.	%
Production	11	33	0.13
	21	129	0.50
	22	720	2.77
	23	680	2.62
	31	1127	4.34
	32	2494	9.60
	33	6556	25.25
Services	42	20	0.08
	44	2944	11.34
	45	142	0.55
	48	381	1.47
	49	1080	4.16
	51	3662	14.10
	52	1740	6.70
	53	275	1.06
	54	2454	9.45
	56	831	3.20
	61	107	0.41
	62	109	0.42
	71	84	0.32
	72	400	1.54
	Total	25,968	100.00

Notes: Percentage values are defined on column total. The category 'production' includes agriculture, mining and extraction, utilities, construction and manufacturing sectors.

higher the index, the more diversified the industrial profile characterising the set of inward greenfield FDI set up in a region. Figure 3 maps the spatial distribution of the inverse HHI on FDI, and it highlights high heterogeneity both within and across countries.

The FDI-related variables are defined, as in Equations (3) and (4), with respect to the two sectoral categories (production and services) to test for FDI-driven heterogeneous effects.

Drawing on the well-established endogenous growth literature, Equation (2) includes a set of log-transformed region-specific control variables defined at the beginning of the growth period, that is, the year 2008. First, the vector X_r^k includes a labour productivity variable ($\text{labour productivity}_r$), defined as GDP over employment, to test for the convergence hypothesis (Barro and Sala-i-Martin, 1992). Second, it includes a measure of human capital (human capital_r), defined as the percentage of population aged 25–64 years with tertiary education, to control for the role played by human-embedded knowledge and skills in raising productivity (e.g., Crescenzi et al., 2016; Arbia et al., 2010). Third, it includes an inverse HHI capturing the level of regional industrial diversification (IHHI_r), an inverse HHI capturing the level of industrial diversification of a region with respect to its country (IHHI _ Country_r) and the share of employment in the services sector (Services_r). These three variables are aimed at capturing the effect of the local industrial structure on productivity growth (e.g., Castellani and Pieri, 2016; Cainelli et al., 2007).[7] Finally, it includes a population density measure ($\text{population density}_r$), defined as population per square kilometre, to proxy for urban agglomeration externalities arising from the local availability of universities, research centres, infrastructures and knowledge-intensive firms, among others (e.g., Crescenzi et al., 2007).

The right-hand side of Equation (2) also includes a (log-transformed) pre-crisis measure of regional FDI attractiveness (attractiveness_r) defined as the share of foreign firms operating in 2006 in a region, independently of the entry mode adopted by the foreign investor—that is, both greenfield and brownfield FDI.[8] The motivation of its inclusion in the regression equation is twofold. First, this variable proxies for the overall level of attractiveness of a region with respect to MNEs. This helps to relax a potential drawback of the empirical analysis, which considers only greenfield FDI due to data availability. Second, its pre-crisis temporal definition allows for the capture of the effective regional attractiveness, as the Great Recession may have significantly altered the FDI dynamics.[9]

Identification strategy

Equation (2) can be easily estimated via OOrdinary Least SSquares (OLS). However, the estimated coefficients of the FDI-related variables are likely to be biased due to potential endogeneity. The simultaneity characterising the temporal definition of the dependent and the FDI-related variables—all referring to the 2008–2014 period—can lead to reverse causality; that is, it could be that inward FDI fosters regional labour productivity growth, but regions characterised by higher growth rates could attract more FDI, as well as a more 'suitable' industrial profile of the investments. Moreover, shocks occurring at the regional level are likely to influence both the economic performance of a region and its FDI dynamics.

Therefore, an instrumental variable (IV) approach is employed to mitigate the potential reverse causality bias. The identification strategy exploits information available for the 179 US Economic Areas (EA) identified by the US Bureau of Economic Analysis in 2004, and it consists of using FDI-related variables constructed for the US EAs and referring to the 2008–2014 period as instruments for the EU regions' FDI-related variables.. Specifically, 174 out of the 179 US EAs received greenfield FDI over the period analysed.

The IVs have been constructed by matching each EU region in the sample with the sample of US EAs based on a

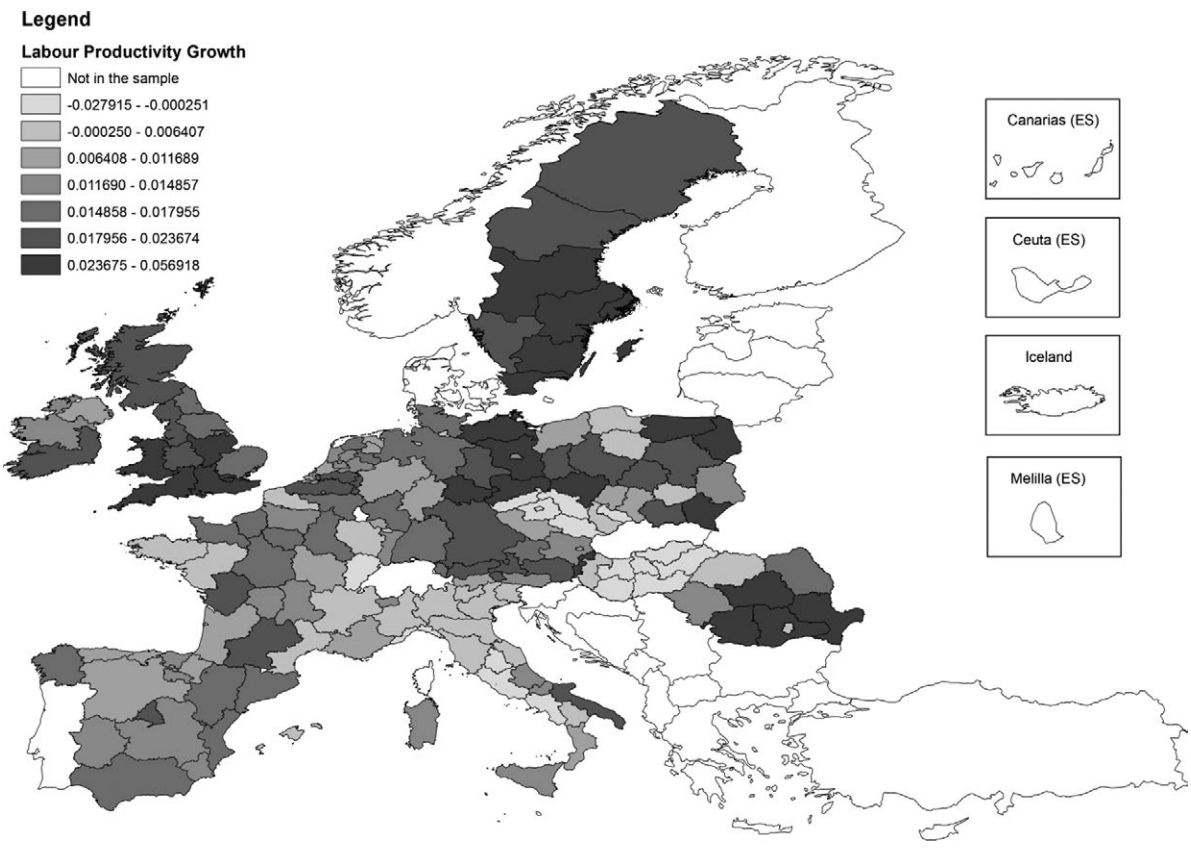

Figure 2. Spatial distribution of average yearly labour productivity growth. *Notes*: The distribution is based on the average yearly labour productivity growth over the 2008-2014 period.

series of pre-crisis characteristics. Specifically, two pre-crisis dimensions have been considered: structural factors and inward FDI dynamics. The set of structural factors includes the time averages defined over the 2003–2007 period of innovation output, per capita wealth, unemployment rate, human capital and population density.[10] These variables represent standard factors influencing the location choices of MNEs (e.g., Billington, 1999; Crescenzi et al., 2014; Head and Mayer, 2004; Iammarino and McCann, 2013; Py and Hatem, 2009), such that EU regions and US EAs with similar structural factors are likely to present a similar FDI dynamics. The inward FDI dynamics during the 2003–2007 period are captured through three measures: the number of inward investments set up, a HHI defined on two-digit NAICS sectors and the share of inward investments received with respect to Europe (for EU regions) and the US (for US EAs). This second set of variables exploits a break in inward FDI, which has characterised Europe and the US. As Panel A in Figure 4 shows, both Europe and the US presented an increasing pattern of inward greenfield FDI over the 2003-2007 period, while the year 2008 represented a breakpoint in this trend: while the number of inward greenfield FDI in Europe has started to decrease, it has significantly increased in the US. This temporal dynamic is confirmed using data drawn from UNCTAD's (2016) '*World Investment Report*'—see Panel B in Figure 4. The rationale for including pre-2008 FDI-based variables in the matching procedure is twotwofold: first, the pre-crisis 'parallel' trend is likely to increase the precision of the matching between EU regions and US EAs; second, the 2008 breakpoint relaxes the issue concerning time persistence in the dynamics of inward investments (e.g., Crescenzi et al., 2014; Head and Mayer, 2004).

The Euclidean distance between each EU region $r = 1, \ldots\ldots, 159$ and each US EA $ea = 1, \ldots\ldots, 174$ has been calculated on the vector V^k including the mean-standardised values of the two sets of variables previously described:[11]

$$d_{r,ea} = \sqrt{\sum_{k=1}^{K} \left(V_r^k - V_{ea}^k\right)^2}, \tag{5}$$

Then, the IVs have been constructed as the mean values of the corresponding US EAs' FDI-related variables weighted by the inverse of the calculated distances:[12]

$$\text{IV\_US}_r^{\text{FDI}} = \frac{1}{174}\left\{\sum_{ea=1}^{174}\left[\log\left(\text{FDI}_{ea}\right)\cdot d_{r,ea}^{-1}\right]\right\} \tag{6}$$

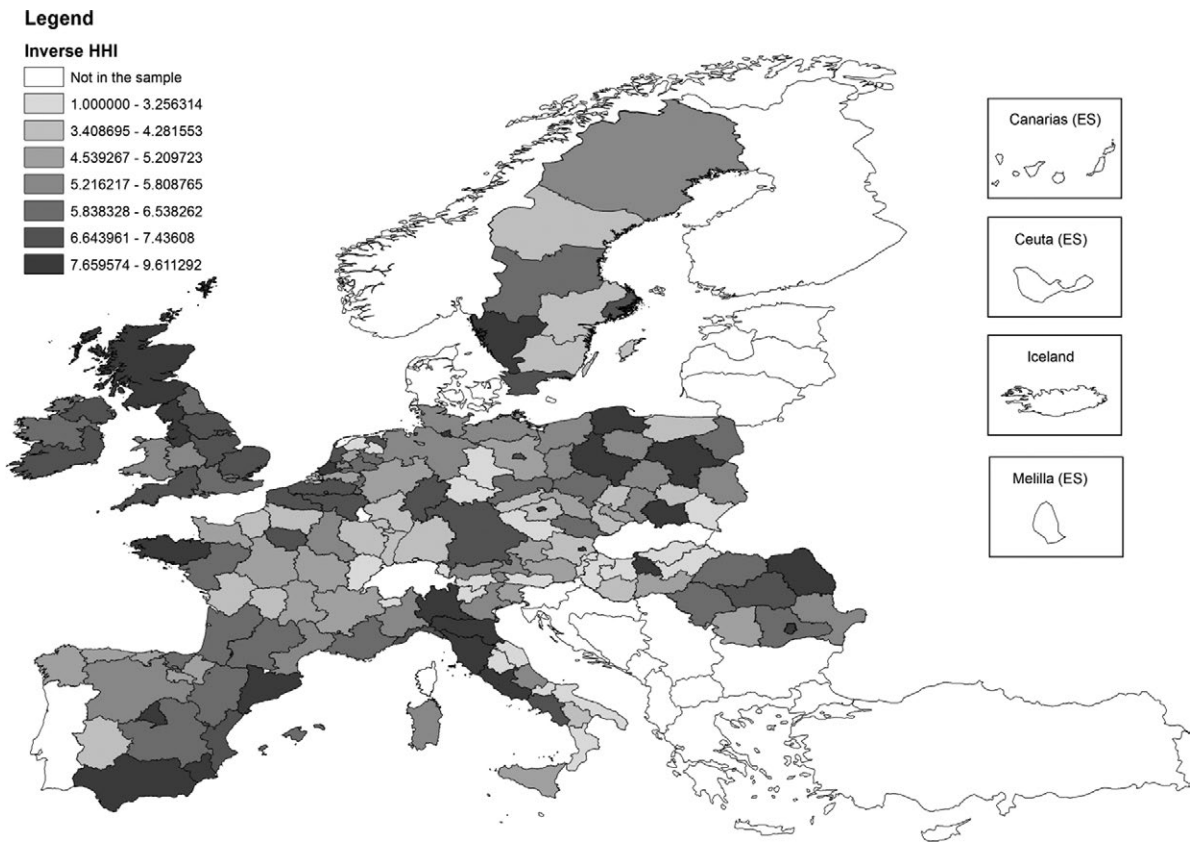

Figure 3. Spatial distribution of the inverse HHI on inward greenfield FDI. *Notes*: The distribution is based on the inverse HHI calculated on the number of inward greenfield FDI set up over the 2008-2014 period.

$$IV\_US_r^{\text{IHHI}\ \_\ \text{FDI}} = \frac{1}{174}\left\{\sum_{ea=1}^{174}\left[\log\left(\text{IHHI}\ \_\ \text{FDI}_{ea}\right)\cdot d_{r,ea}^{-1}\right]\right\} \quad (7)$$

where the terms FDI_{ea} and $\text{IHHI}\ \_\ \text{FDI}_{ea}$ denote the FDI-related variables constructed for the US EAs over the 2008–2014 period as in Equations (3) and (4).

Following the same rationale as in Ellison et al. (2010), the validity of the identification strategy relies on the presence of a correlation between MNEs' location choice determinants and inward FDI in both Europe and the US, and the absence of correlation between idiosyncratic patterns characterising the inward FDI dynamics in Europe and the US in the post-crisis period—see also Diodato et al. (2018). The IV approach has been implemented through a Two-Stage Least Squares (TSLS) estimator.

Empirical results

Main results

Table 4 reports the results of the OLS and TSLS estimations of Equation (2). The robustness of the empirical labour productivity growth equation has been tested by comparing the baseline convergence equation reported in Column (1) with the augmented ones reported in Columns (2)–(5). In line with the standard growth literature, the convergence parameter shows a negative and statistically significant coefficient, with elasticity ranging between 1.1% and 1.7%. Moreover, region-specific control variables maintain their sign when the FDI-related variables are added to the set of explanatory variables in Columns (3) to (5). Specifically, the regional short-run labour productivity growth seems to be positively associated with human capital endowment, while a negligible association emerges with the other controls. The key results reported in Column (5) suggest a statistically significant association between labour productivity and inward FDI. On the one hand, the presence of brand new foreign capital is positively associated with regional labour productivity growth. On the other hand, it emerges that regional growth is positively associated with a set of inward FDI concentrated in a limited number of sectors.[13]

These results are confirmed once the endogeneity of the FDI-related variables is controlled for. The validity of the IV approach is confirmed by the first-stage multivariate *F* statistics (Sanderson and Windmeijer, 2016) of

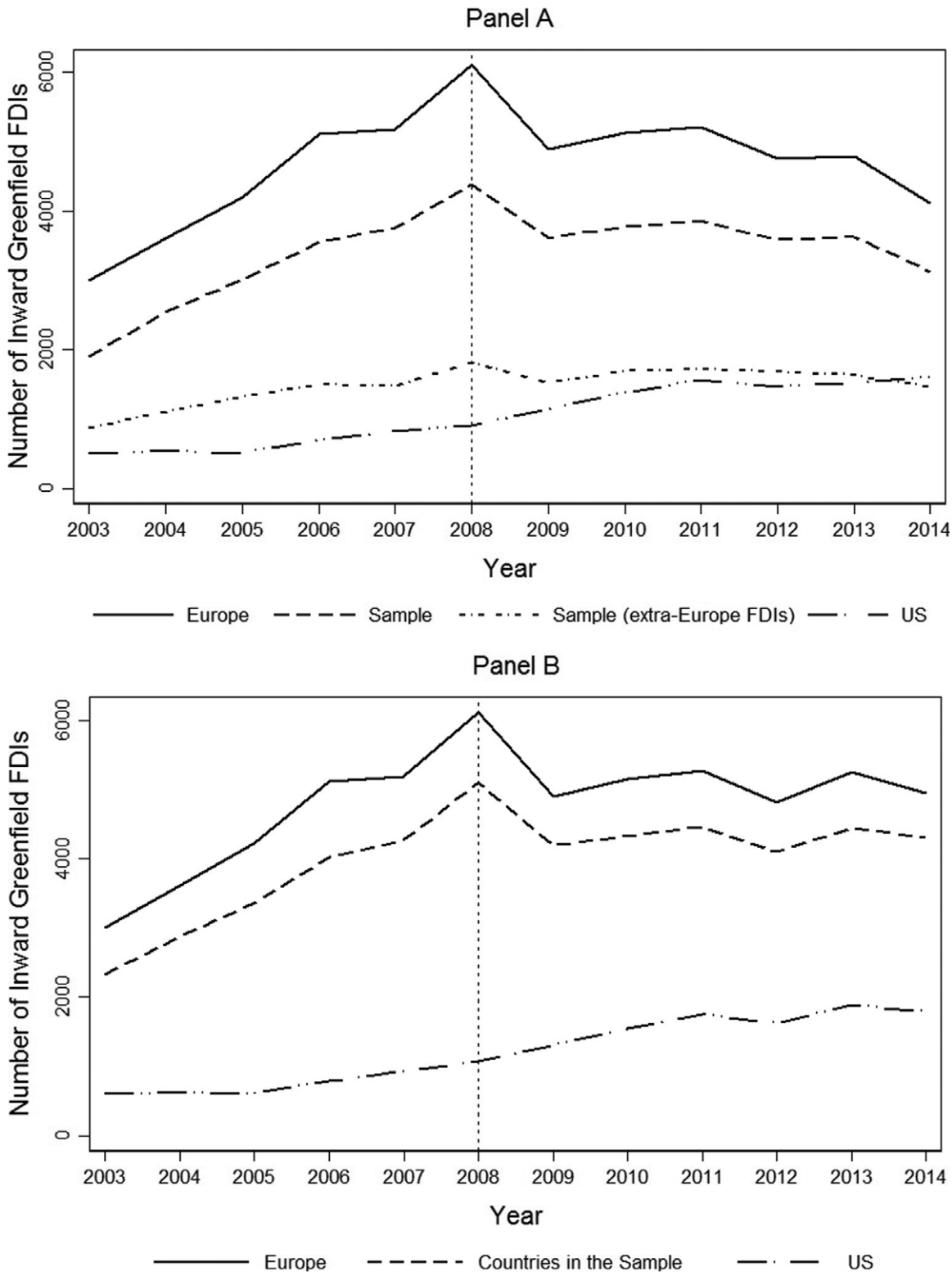

Figure 4. Temporal dynamics of inward greenfield FDI in Europe and the United States. *Notes*: Panel A is based on the *fDi Market* database used in the empirical analysis. Panel B is based on data drawn from the UNCTAD's (2016) "*World Investment Report*".

Table 4. Inward greenfield FDI and labour productivity growth.

Dependent variable	Δlabour productivity$_r$							
Estimation method	**OLS**					**TSLS**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
log(labour productivity$_r$)	–0.011***	–0.014***	–0.017***	–0.015***	–0.014***	–0.020***	–0.015***	–0.015***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
log[human capital$_r$/(1 – human capital$_r$)]	…	0.006*	0.009***	0.006**	0.006**	0.007*	0.008**	0.008**
		(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
log(IHHI$_r$)	…	–0.002	–0.000	–0.000	–0.000	0.002	0.001	0.001
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
log(IHHI_Country$_r$)	…	–0.000	–0.000	–0.000	–0.000	–0.000	–0.000	–0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log[services$_r$/(1 – services$_r$)]	…	0.002	0.002	0.002	0.002	0.002	0.002	0.002
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
log(population density$_r$)	…	–0.000	–0.001	–0.001	–0.001	–0.002**	–0.001	–0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log[attractiveness$_r$/(1 – attractiveness$_r$)]	…	…	…	…	–0.000	…	…	–0.000
					(0.001)			(0.001)
log(FDI$_r$)	…	…	0.001***	0.002***	0.002***	0.002***	0.004***	0.004***
			(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log(IHHI_FDI$_r$)	…	…	…	–0.005**	–0.005**	…	–0.013***	–0.013***
				(0.002)	(0.002)		(0.005)	(0.005)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of regions	159	159	159	159	159	159	159	159
H_0: Homoskedasticity (χ^2, [p value])	83.92 [0.000]	107.02 [0.000]	117.34 [0.000]	122.44 [0.000]	122.74 [0.000]	34.98 [0.020]	32.91 [0.047]	33.38 [0.057]
R^2	0.63	0.65	0.67	0.67	0.67	…	…	…
Adjusted R^2	0.60	0.60	0.62	0.61	0.61	…	…	…
Model F statistic [p value]	21.67 [0.000]	20.99 [0.000]	21.31 [0.000]	20.94 [0.000]	19.33 [0.000]	20.59 [0.000]	16.40 [0.000]	15.56 [0.000]
H_0: Country dummies = 0 (F, [p value])	22.42 [0.000]	15.01 [0.000]	17.30 [0.000]	15.41 [0.000]	16.27 [0.000]	15.98 [0.000]	14.73 [0.000]	14.99 [0.000]
H_0: Heterogeneity (χ^2, [p value])	…	…	…	…	…	3.57 [0.059]	7.31 [0.026]	7.58 [0.023]
First-stage S–W F statistic on log (FDI$_r$) [p value]	…	…	…	…	…	13.79 [0.000]	84.39 [0.000]	88.16 [0.000]

Table 4. Continued

Dependent variable	Δlabour productivity$_r$							
Estimation method	**OLS**					**TSLS**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
S–W underidentification test on log(FDI$_r$) (χ^2, [p value])	…	…	…	…	…	15.89 [0.000]	97.94 [0.000]	103.07 [0.000]
Shea's partial R^2 on log(FDI$_r$)	…	…	…	…	…	0.17	0.35	0.37
First-stage S–W F statistic on log(IHHI_FDI$_r$) [p value]	…	…	…	…	…	…	23.58 [0.000]	24.59 [0.000]
S–W underidentification test on log(IHHI_FDI$_r$) (χ^2, [p value])	…	…	…	…	…	…	27.36 [0.000]	28.75 [0.000]
Shea's partial R2 on log(IHHI_FDI$_r$)	…	…	…	…	…	…	0.15	0.16

Notes: $^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$. Robust standard errors are reported in parentheses. All specifications include a constant term. Homoskedasticity is tested through the tests developed by Breusch and Pagan (1979) and Pagan and Hall (1983) for, respectively, the OLS and TSLS estimators. The first-stage S–W F statistic refers to Sanderson and Windmeijer's (2016) multivariate F statistic. The first-stage S–W underidentification test refers to Sanderson and Windmeijer's (2016) underidentification test on single endogenous regressors. The instrumental variables used in specifications (6)–(8) are the weighted averages of the endogenous variables computed for 174 US EAs, where weights correspond to the Euclidean distances calculated on pre-crisis variables between each EU region and each US EA.

the excluded instruments, which are higher than the conservative cut-off value of 10 for both endogenous regressors.[14] Moreover, Sanderson and Windmeijer's (2016) underidentification test suggests that both endogenous regressors are identified. The results reported in Columns (6) to (8) confirm the positive 'absolute size' effect of inward FDI as well as that labour productivity growth is fostered by an industrial profile of inward investments, which is based on a limited number of sectors, as suggested by the negative estimated coefficient of the inverse HHI on FDI. Specifically, it emerges that a 1% increase in the amount of FDI received pushes up labour productivity growth by 0.4%, while a 1% reduction in industrial diversification pushes up productivity growth by 1.3%. This result seems to suggest that it is not the amount of FDI received *per se* which matters for regions to growth, but the presence of inward FDI concentrated in a limited number of sectors.

Heterogeneous effects

As discussed previously, heterogeneity related to both destination regions and inward FDI is likely to influence the relationship under analysis. Two sources of heterogeneity are of particular interest in the present context: a first one related to the regional industrial profile, and a second one related to the sectoral dimension of inward FDI.

Table 5 reports the results of the TSLS estimation of Equation (2), accounting for regional heterogeneity in terms of industrial profile. The sample of regions has been split to test which industrial profile of inward FDI is more suitable for an economy characterised by an industrial profile based on a low (high) number of sectors. The distribution of the log-transformed variable capturing regional industrial diversification (IHHI$_r$) has been tested against the null hypothesis of log-normality to identify a proper threshold value at which splitting the sample of regions. The skewness test rejects the log-normality assumption with a p value equal to 0.002, and the comparison of the mean (1.48) and median (1.49) values points towards a left-skewed distribution. Therefore, regions characterised by a value of industrial diversification lower than or equal to the median have been labelled as lowly diversified, while regions characterised by a value higher than the median have been labelled as highly diversified.

The results suggest that inward investments have a significant effect on labour productivity growth of lowly diversified regions only. The estimated coefficients of the FDI-related variables are never statistically different from zero for the sub-sample of highly diversified regions. These results underline the importance of accounting for the local industrial profile in defining regional interventions to attract MNEs. It seems that not all regions benefit equally from foreign investments.[15]

Table 6 reports the results of the TSLS estimation of Equation (2) accounting for FDI sectoral-driven heterogeneity, that is, by considering separately inward FDI

Table 5. Heterogeneous effects by regional industrial profile: TSLS results.

Dependent variable	Δlabour productivity$_r$			
Regional industrial diversification	**Low**	**High**	**Low**	**High**
	(1)	**(2)**	**(3)**	**(4)**
log(labour productivity$_r$)	–0.017**	–0.010	–0.016**	–0.011
	(0.007)	(0.008)	(0.007)	(0.008)
log[human capital$_r$/(1 – human capital$_r$)]	0.002	0.007	0.002	0.008*
	(0.005)	(0.004)	(0.005)	(0.004)
log (IHHI$_r$)	…	…	–0.013	0.029
			(0.013)	(0.020)
log (IHHI_Country$_r$)	–0.000	–0.000	–0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)
log [services$_r$/ (1 – services$_r$)]	0.002	0.007	0.001	0.007
	(0.002)	(0.006)	(0.002)	(0.006)
log (population density$_r$)	–0.000	–0.002	–0.001	–0.002
	(0.001)	(0.002)	(0.001)	(0.002)
log [attractiveness$_r$/ (1 – attractiveness$_r$)]	0.001	–0.002	0.001	–0.003
	(0.002)	(0.002)	(0.002)	(0.002)
log (FDI$_r$)	0.005***	0.002	0.005***	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
log (IHHI_FDI$_r$)	–0.018***	–0.008	–0.016***	–0.007
	(0.006)	(0.008)	(0.005)	(0.008)
Country dummies	Yes	Yes	Yes	Yes
No. of regions	82	77	82	77
Model *F* statistic [*p* value]	8.51 [0.000]	12.90 [0.000]	8.96 [0.000]	14.27 [0.000]
First-stage S–W *F* statistic on log (FDI$_r$) [*p* value]	45.46 [0.000]	25.12 [0.000]	49.35 [0.000]	24.84 [0.000]
S–W underidentification test on log (FDI$_r$) (χ^2, [*p* value])	61.11 [0.000]	33.35 [0.000]	67.45 [0.000]	33.56 [0.000]
Shea's Partial *R2* on log (FDI$_r$)	0.40	0.29	0.38	0.30
First-stage S–W *F* statistic on log (IHHI_FDI$_r$) [*p* value]	11.54 [0.001]	14.80 [0.000]	11.07 [0.002]	14.22 [0.000]
S–W underidentification test on log (IHHI_FDI$_r$) (χ^2, [*p* value])	15.51 [0.000]	19.65 [0.000]	15.13 [0.000]	19.21 [0.000]

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard errors are reported in parentheses. All specifications include a constant term. The first-stage S–W *F* statistic refers to Sanderson and Windmeijer's (2016) multivariate *F* statistic. The first-stage S–W underidentification test refers to Sanderson and Windmeijer's (2016) underidentification test on single endogenous regressors. The instrumental variables are the weighted averages of the endogenous variables computed for 174 US EAs, where weights correspond to the Euclidean distances calculated on pre-crisis variables between each EU region and each US EA. Low and high regional industrial diversification correspond to values ≤ 1.49 and > 1.49, respectively, where the threshold value (1.49) is the median of the distribution of log(IHHI$_r$).

concerning production and service sectors. The comparison of the estimated coefficients reported in Columns (1) and (2) clearly suggests that regional labour productivity growth benefits from services inward FDI, while production FDI seems to play an almost negligible role. First, it emerges that production FDI does not influence regional growth *per se*. Second, the estimated coefficient of the inverse HHI on production FDI shows a lower significance level with respect to both the services counterpart and the main results presented in Column (6) of Table 4. These results are confirmed when the effect of production FDI is tested on the sub-sample of 154 regions which receive investments both in the production and the services sectors—see Column (3). On the contrary, the results on services FDI confirm the main findings.

This result is in line with some previous studies finding a positive effect of services FDI on the performance of both firms and regions. For example, Fernandes and Paunov (2012) find that services FDI positively influences Chilean manufacturing user firms' total factor productivity, while neither mining nor manufacturing FDI has statistically significant effects. Similarly, Casi and Resmini (2017) find that services FDI has a positive effect on the economic growth of EU regions while manufacturing FDI has a negligible effect. The different effects played by FDI in the production and services sectors may depend on the aim and nature

Table 6. Heterogeneous effects by sectoral category: TSLS results.

Dependent Variable	Δlabour productivity$_r$				
Regional Sectoral Type				**Production Intensive**	**Services Intensive**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
log(labour productivity$_r$)	−0.020***	−0.019***	−0.020***	−0.016**	−0.015*
	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)
log[human capital$_r$/1 − human capital$_r$)]	0.010**	0.007**	0.010**	0.004	0.008
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
log(IHHI$_r$)	0.000	0.004	0.001	−0.005	−0.019
	(0.008)	(0.008)	(0.009)	(0.015)	(0.017)
log(IHHI_Country$_r$)	−0.000	−0.000	−0.000	−0.000	−0.001**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
log[services$_r$/(1 − services$_r$)]	0.003	0.001	0.003	0.000	−0.004
	(0.002)	(0.003)	(0.003)	(0.005)	(0.007)
log(population density$_r$)	−0.000	−0.000	−0.000	−0.000	−0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
log[attractiveness$_r$/(1 − attractiveness$_r$)]	−0.003*	0.003	−0.003	−0.001	0.006**
	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)
log($FDI_r^{Production}$)	0.002	…	0.002	…	…
	(0.001)		(0.001)		
log($IHHI\_FDI_r^{Production}$)	−0.022**	…	−0.021**	…	…
	(0.008)		(0.009)		
log($FDI_r^{Services}$)	…	0.004***	…	0.000	0.004***
		(0.001)		(0.002)	(0.002)
log($IHHI\_FDI_r^{Services}$)	…	−0.014***	…	−0.002	−0.014***
		(0.005)		(0.007)	(0.005)
Country dummies	Yes	Yes	Yes	Yes	Yes
No. of regions	159	154	154	69	85
Model *F* statistic [*p* value]	11.49 [0.000]	11.46 [0.000]	11.46 [0.000]	21.26 [0.000]	1,004.53 [0.000]
First-stage S–W *F* statistic on log(FDI$_r$) [*p* value]	92.22 [0.000]	32.58 [0.000]	99.22 [0.000]	29.19 [0.000]	21.76 [0.000]
S–W underidentification test on log(FDI$_r$) (χ^2, [*p* value])	107.82 [0.000]	38.30 [0.000]	116.64 [0.000]	42.86 [0.000]	29.84 [0.000]
Shea's partial *R*2 on log (FDI$_r$)	0.38	0.21	0.40	0.37	0.25
First-stage S–W *F* statistic on log(IHHI_FDI$_r$) [*p* value]	11.92 [0.001]	21.84 [0.000]	9.45 [0.003]	10.14 [0.003]	14.94 [0.000]
S–W underidentification test on log(IHHI_FDI$_r$) (χ^2, [*p* value])	13.93 [0.000]	25.67 [0.000]	11.11 [0.001]	14.89 [0.000]	20.49 [0.000]
Shea's partial *R*2 on log(IHHI_FDI$_r$)	0.08	0.12	0.07	0.21	0.18

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard errors are reported in parentheses. All specifications include a constant term. The first-stage S–W F statistic refers to Sanderson and Windmeijer's (2016) multivariate F statistic. The first-stage S–W underidentification test refers to Sanderson and Windmeijer's (2016) underidentification test on single endogenous regressors. The instrumental variables are the weighted averages of the endogenous variables computed for 174 US EAs, where weights correspond to the Euclidean distances calculated on pre-crisis variables between each EU region and each US EA. The Stock and Yogo's (2005) critical values are 7.03 for 10% maximal IV size; 4.58 for 15% maximal IV size: 4.58; 3.95 for 20% maximal IV size and 3.63 for 25% maximal IV size. The Kleibergen and Paap's (2006) rank Wald F statistic for Column (3) equals 4.57. Low and high regional shares of services employment correspond to values ≤ −0.60 and > −0.60, respectively, where the threshold value (–0.60) is the mean of the distribution of log [Services$_r$/ (1 − Services$_r$)].

of the activity effectively run by foreign affiliates in the host region. On the one hand, the almost negligible effect played by production FDI could be the result of either the export orientation or the asset-seeking activity of foreign affiliates, which, therefore, do not effectively interact with domestic firms and, consequently, do not operate as externality generators. On the other hand, foreign affiliates in the services sector either tend to operate in strict relation with domestic firms—independently of their sector of activity—or serve directly the local market, being them set up to exploit advantages arising from the proximity to local customers in the host region. Consequently, services FDI is likely to contribute effectively to a positive economic performance of the host region (Casi and Resmini, 2017).

Moving from this last result, the role of services FDI has been tested further with respect to regions' endowment of services activity. To this aim, the 154 regions receiving services FDI have been split around the mean value of the log-transformed variable capturing the regional share of employment in services.[16] The comparison of the results reported in Columns (4) and (5) clearly suggests a 'services-to-services' profile. Services-intensive regions benefit from inward investments in the services sector, and specifically from receiving services FDI concentrated in a limited number of sectors. On the contrary, services FDI seems to have a negligible effect on the labour productivity growth of manufacturing-intensive regions.[17]

This result is in line with the contribution by Antonietti et al. (2015) on the Italian case, which shows not only that inward services FDI outperforms manufacturing FDI in terms of innovation output but also that services FDI pushes innovation in the knowledge-intensive business services sector only, while a negligible effect emerges between inward FDI and innovation within the manufacturing sector or across services and manufacturing activities. This 'services-to-services' pattern may result from the fact that, as shown by Resmini (2013), foreign affiliates in the services sector tend to locate close to other service producers to exploit agglomeration externalities and labour market pooling advantages, and to serve markets already highly services-oriented.

To clearly identify the role played by services FDI, Equation (2) has been augmented with the interaction terms between the variable capturing the regional share of services employment and the two services FDI-related variables, respectively. Table 7 reports the first-stage statistics of the TSLS estimation of the augmented version of Equation (2), while Figure 5 plots the estimated elasticities of the FDI variables and confirms the findings reported in Columns (4) and (5) of Table 6. Therefore, it emerges that for regions to leverage on inward FDI to boost their economic performance it is necessary to identify—and selectively engage in—an *ad hoc* industrial strategy which exploits and maximises the assets already available at the local level, at least during a short run, post-crisis period.

Alignment between regions' industrial profile and inward FDI

Drawing from the previous results, the alignment between a region's industrial profile and inward FDI investments has been further tested by relying on a simple index capturing whether and to what extent gains in labour productivity growth are driven by complementarity between the pre-crisis industrial structure of a region and the set of brand new investment inflows that entered in the short run, post-crisis period.

The 'alignment' index (Alignment Index_r) has been constructed with respect to four sectoral branches that are available in the Cambridge Econometrics' *European Regional Database* and in which inward FDI has been realised, namely: (i) industry (excluding construction); (ii) construction; (iii) wholesale, retail, transport and distribution, communications, hotels and catering and (iv) financial and business services.[18] Specifically, the index has been defined to capture the number of macro-sectors with respect to which a region shows alignment between its own pre-crisis industrial structure and the post-crisis set of inward FDI. To this aim, the relative contribution of each macro-sector to the regional economy (in terms of employment) in the 2000–2007 period and to the total amount of inward FDI set up (in terms of number of investments) in the 2008–2014 period has been computed. Second, the quintile distribution of the two series with respect to each macro-sector has been calculated. Third, a value of 1 has been assigned to each macro-sector with respect to which the two series lie in the same quintile of the distribution. Finally, the total number of 'aligned' macro-sectors per region has been calculated, and it has been divided with respect to the maximum number of macro-sectors considered (i.e., 4). Therefore, the 'alignment' index ranges in the interval $[0, 1]$: a value of 0 denotes 'complete mismatch' between a region's industrial profile and inward FDI, while a value of 1 denotes 'complete alignment'.[19]

To test for 'alignment' between a region's pre-crisis industrial profile and the post-crisis set of inward FDI set-up, Equation (2) has been augmented by the 'alignment' index and estimated via both OLS and TSLS. The results of this exercise, which are reported in Table 8, suggest a positive and statistically significant correlation between regions' labour productivity growth and the degree of 'alignment'. Moreover, the results concerning the inward FDI variables are fully corroborated.

Robustness analyses

A series of tests has been performed to check the robustness of the results. All tables reporting the estimated specifications are included in Online Appendix.

First, Equation (2) is estimated by excluding the bottom and top 5%, 10% and 25% FDI-receiving regions with respect to the share of foreign firms existing in 2006. The

Table 7. First-stage statistics of the interaction model on services FDI variables.

Endogenous variable	*F* statistic	Underidentification test (χ^2)
$\log(\text{FDI}_r^{\text{Services}})$	33.93 [0.000]	40.51 [0.000]
$\log(\text{IHHI\_FDI}_r^{\text{Services}})$	27.10 [0.000]	32.35 [0.000]
$\log(\text{FDI}_r^{\text{Services}}) \times \log[\text{services}_r/(1-\text{services}_r)]$	21.07 [0.000]	25.15 [0.000]
$\log(\text{IHHI\_FDI}_r^{\text{Services}}) \times \log[\text{services}_r/(1-\text{services}_r)]$	44.39 [0.000]	53.00 [0.000]

Notes: *p* values are reported in brackets. The first-stage *F* statistic refers to Sanderson and Windmeijer's (2016) multivariate *F* statistic. The first-stage underidentification test refers to Sanderson and Windmeijer's (2016) underidentification test on single endogenous regressors. The instrumental variables are the weighted averages of the endogenous variables computed for 174 US EAs, where weights correspond to the Euclidean distances calculated on pre-crisis variables between each EU region and each US EA. The interaction terms are instrumented with the interactions between the external IVs and the variable capturing the regional share of services employment. The full table of results with all estimated coefficients is available from the authors upon request.

rationale of this exercise is to evaluate whether the FDI-related effects are driven by some threshold level in FDI attractiveness. As Table A5 shows, the results confirm the previous ones in all cases: first, the positive effect of inward FDI shows an elasticity equal to 0.4%; second, the results confirm a negative effect of the industrial diversification FDI variable, with an estimated coefficient ranging in the interval [−0.014, −0.012].

Second, the same exercise is performed with respect to services FDI. As Table A6 shows, the results confirm those reported in Column (2) of Table 6: the positive effect of services FDI ranges in the interval [0.003, 0.004], while the negative industrial diversification effect ranges in the interval [−0.017, −0.012].

Third, the robustness of the results is tested by replicating the TSLS estimation of the main specification reported in Column (6) of Table 4 using an alternative identification strategy, which follows Autor and Duggan's (2003) modification of the shift-share approach originally proposed by Bartik (1991). The proposed IVs use pre-crisis shares of regional inward FDI and changes in inward FDI at the European level over the 2003–2007 and 2008–2014 periods to instrument post-crisis variables capturing the FDI dynamics at the regional level. The main idea is that region-specific FDI dynamics would have observed a change during the crisis period which is proportional to its pre-crisis condition in the absence of region-specific shocks. Specifically, two IVs are constructed under this rationale. The first one ($\text{IV\_B}_r^{\text{FDI}}$) exploits regional variations to instrument the variable capturing the log-number of inward FDI:

$$\text{IV\_B}_r^{\text{FDI}} = \left(\frac{\text{FDI}_{r,t0}}{\sum_{r=1}^{R}\text{FDI}_{r,t0}}\right) \cdot \left[\log\left(\text{FDI}_{(-r),t1}\right) - \log\left(\text{FDI}_{(-r),t0}\right)\right] \quad (8)$$

where the term $\text{FDI}_{r,t0}$ denotes the number of investments received by the region *r* during the 2003–2007 pre-crisis period (t_0), while the terms $\text{FDI}_{(-r),t0}$ and $\text{FDI}_{(-r),t1}$ denote the number of inward FDI set up in Europe, excluding the reference region *r*, during the pre-crisis (t_0) and post-crisis (t_1) periods. The second one ($\text{IV\_B}_r^{\text{IHHI\_FDI}}$) exploits sector-specific regional variations to instrument the inverse HHI on FDI:

$$\text{IV\_B}_r^{\text{IHHI\_FDI}} = \sum_{s=1}^{S}\left\{\left(\frac{\text{FDI}_{r,s,t0}}{\sum_{s=1}^{S}\text{FDI}_{r,s,t0}}\right) \cdot \left[\log\left(\text{FDI}_{(-r),s,t1}\right) - \log\left(\text{FDI}_{(-r),s,t0}\right)\right]\right\},$$

where the term $\text{FDI}_{r,s,t0}$ denotes the number of investments received by the region *r* in the sector *s* during the 2003–2007 pre-crisis period (t_0), while the terms $\text{FDI}_{(-r),s,t0}$ and $\text{FDI}_{(-r),s,t1}$ denote the number of inward FDI concerning sector *s* set up in Europe, excluding the reference region *r*, during the pre-crisis (t_0) and post-crisis (t_1) periods. As Table A7 shows, the results fully confirm the previous findings.

Fourth, the robustness of the results is tested by augmenting Equation (2) with a variable capturing the percentage of employment in high-tech sectors in 2008. The TSLS estimates are reported in Table A8 and corroborate the main results.[20]

Fifth, the robustness of the results is tested by considering labour productivity growth over the 2008–2015 and 2015–2018 periods, respectively, rather than over the 2008–2014 period. The aim of this exercise is, first, to relax further potential simultaneity biases and, second, to allow for a slower regional recovery following the Great Recession. The TSLS estimates are reported in Table A9 and corroborate the main results.[21]

Sixth, the robustness of the results is tested by augmenting Equation (2) with the spatial lags of the FDI variables, which are constructed by relying on three alternative spatial weights matrices, namely: a row-standardised binary matrix; a row-standardised inverse-distance matrix; and a row-standardised inverse-distance matrix with square decay parameter. The results of this exercise are reported in Table A10; on the one hand, the results concerning FDI in the own region are fully corroborated; on the other hand, there is no evidence of a statistically significant association between labour productivity growth and neighbouring regions' inward FDI.[22]

Finally, the robustness of the results is tested by using an M&A measure of inward FDI. This exercise aims at evaluating whether the main results depend on the

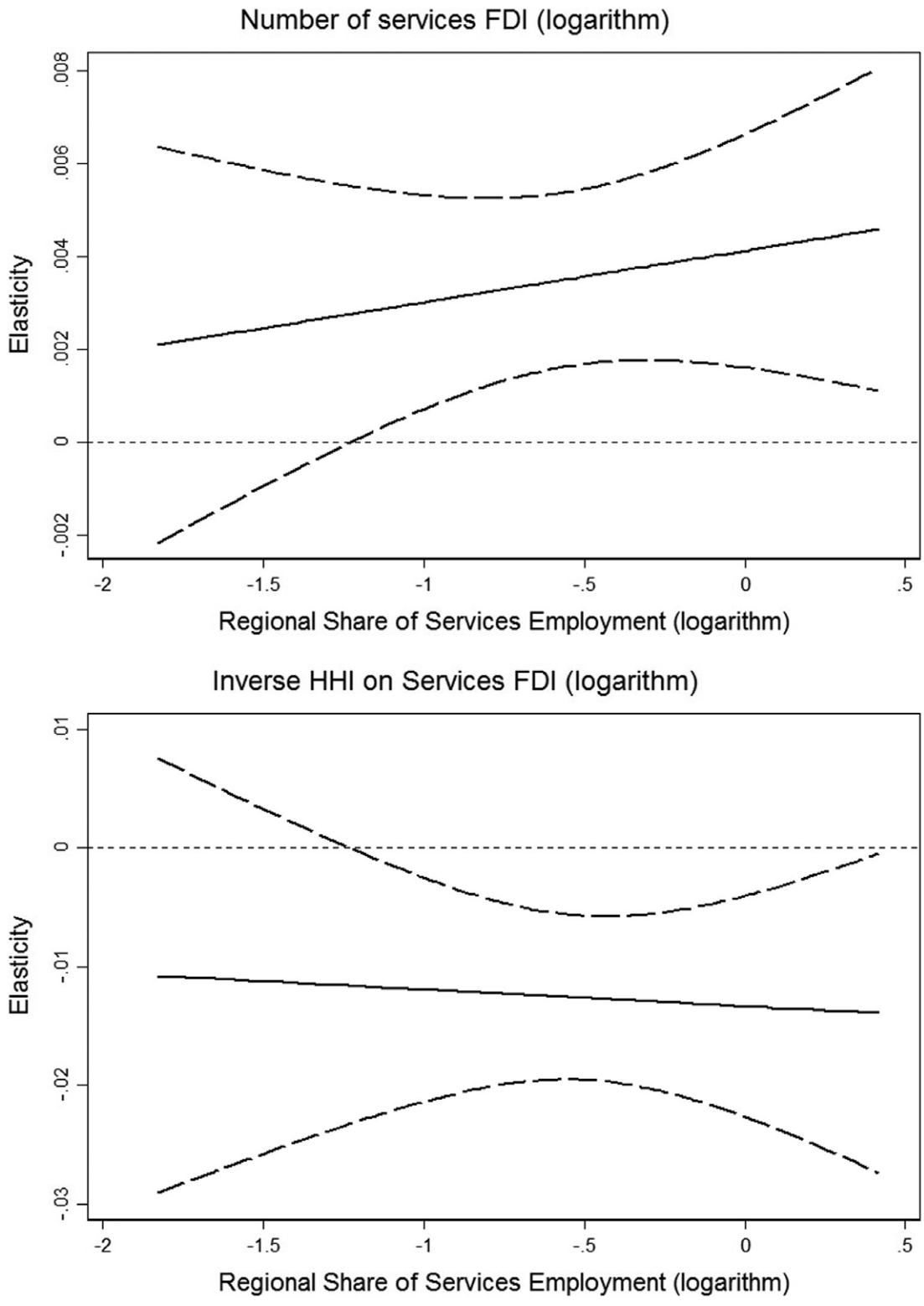

Figure 5. Elasticities of services FDI variables by regional share of services employment.

Table 8. Alignment between regional industrial profile and inward FDI.

Dependent variable	ΔLabour Productivity$_r$		
Estimation method	**OLS**		**TSLS**
	(1)	**(2)**	**(3)**
log(labour productivity$_r$)	…	–0.015***	–0.016***
		(0.002)	(0.004)
log[human capital$_r$/(1 – human capital$_r$)]	…	0.011***	0.010***
		(0.003)	(0.003)
log(IHHI$_r$)	…	0.004	0.004
		(0.009)	(0.009)
log (IHHI_Country$_r$)	…	–0.000	–0.000
		(0.000)	(0.000)
log[services$_r$/(1 – services$_r$)]	…	0.002	0.002
		(0.002)	(0.002)
log(population density$_r$)	…	–0.000	–0.001
		(0.001)	(0.001)
log[attractiveness$_r$/(1 – attractiveness$_r$)]	…	–0.000	–0.000
		(0.001)	(0.001)
log(FDI$_r$)	…	0.002**	0.004***
		(0.001)	(0.001)
log(IHHI_FDI$_r$)	…	–0.006**	–0.014***
		(0.002)	(0.004)
Alignment Index$_r$	0.007**	0.004*	0.006*
	(0.003)	(0.002)	(0.003)
Country dummies	Yes	Yes	Yes
No. of regions	159	159	159
Model *F* statistic [*p* value]	4.50 [0.035]	15.34 [0.000]	14.55 [0.000]
First-stage S–W *F* statistic on log(FDI$_r$) [*p* value]	…	…	74.89 [0.000]
S–W underidentification test on log(FDI$_r$) (χ^2, [*p* value])	…	…	88.86 [0.000]
Shea's partial *R2* on log(FDI$_r$)	…	…	0.33
First-stage S–W *F* statistic on log(IHHI_FDI$_r$) [*p* value]	…	…	33.28 [0.000]
S–W underidentification test on log(IHHI_FDI$_r$) (χ^2, [*p* value])	…	…	39.49 [0.000]
Shea's partial *R2* on log(IHHI_FDI$_r$)	…	…	0.19

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Robust standard errors are reported in parentheses. All specifications include a constant term. The first-stage S–W *F* statistic refers to Sanderson and Windmeijer's (2016) multivariate *F* statistic. The first-stage S–W underidentification test refers to Sanderson and Windmeijer's (2016) underidentification test on single endogenous regressors. The instrumental variables are the weighted averages of the endogenous variables computed for 174 US EAs, where weights correspond to the Euclidean distances calculated on pre-crisis variables between each EU region and each US EA.

greenfield nature of inward FDI. In fact, the economic effects of inward FDI may depend on the type (greenfield vs. M&A) of investment realised in the host economy, as MNEs with different characteristics and motivations may choose different entry modes (Andersson and Svensson, 1994; Blonigen, 1997). For example, Wang and Wong (2009) find that greenfield FDI promotes economic growth more than M&A using a sample of 84 countries observed over the 1987–2001 period. Specifically, the number of M&A realised by the Forbes 2000's companies is employed as an alternative proxy to capture the 'absolute size' effect of foreign investments. Unfortunately, the available data on M&A do not allow to construct a proxy for the industrial profile of M&A-type investments. As a preliminary insight, greenfield FDI and M&A present a very high correlation coefficient, which is equal to 0.91 (0.76 when the variables are log-transformed)—see Table A11. Table A12 reports the results of the OLS estimation, and it suggests that the main findings do not depend on the type of FDI considered. Both estimated coefficients are positive and present the same magnitude and significant level.[23]

Conclusions

The world is grappling with multiple crises and shocks, such as the COVID-19 pandemic, the war in Ukraine, rising protectionism and widespread inequalities between people and places. These issues intersect with long-term megatrends like global warming and rapid technological change, profoundly impacting patterns of economic integration (and disintegration) across countries and regions. In this context, the aftermath of the Great Recession provides critical insights into the regional productivity impacts of (changing) global connectivity through FDI. The recession showed how FDI could drive recovery, yet the current poly-crisis demands a deeper understanding of FDI's role in fostering resilience and addressing inequalities in cities and regions amid ongoing global challenges.

In order to address this relevant knowledge gap, this paper looks at the relationship between inward FDI and regional labour productivity growth in the EU over the short-run period in the aftermath of the Great Recession. In so doing, it offers a threefold contribution to the existing literature. First, it analyses the regional dimension of FDI from a cross-country perspective. Second, it considers the simultaneous occurrence of two different FDI-related effects: a more traditional one related to the presence of foreign firms in the host region, and a novel one related to the industrial profile of inward FDI. Third, it accounts for two main sources of heterogeneity defined in terms of the industrial profile of the destination region and the sectoral type of inward FDI, also giving particular emphasis to the services dimension of FDI.

The results suggest a positive effect of inward FDI on regional labour productivity growth, as well as that regional growth benefits from inward FDI concentrated in a limited number of sectors. It emerges that only regions characterised by an industrial profile based on a limited number of sectors—and, particularly, 'aligned' with the sectoral composition of inward investments—benefit from inward FDI. Finally, it emerges that services FDI plays a much more important role than production FDI and, in particular, it promotes labour productivity growth of services-intensive destination regions only.

The empirical results highlight some key points for reflection with reference to current challenges to global economic integration. First, the effect of inward FDI should be analysed by accounting for its industrial profile. Second, there is an 'optimal' match between inward FDI and host region in terms of industrial profile: regions with an economic structure focussed around a limited number of sectors benefit from inward FDI equally concentrated in a limited number of key sectors. Finally, services FDI outperforms production FDI and matters for the labour productivity growth of services-intensive regions only.

Taken together, these results offer relevant material for policy, especially in the light of the renewed attention by (regional) policymakers on FDI as a tool to promote regional development—see, for example, European Commission (2024). FDI attraction and retention have a marked sub-national and sectoral dimension. This evidence is very well aligned with the idea that public policies for FDI generate tangible impacts when they are designed and implemented at the regional level with the identification of clear priority sectors to be selectively targeted by dedicated regional investment promotion agencies (Crescenzi et al., 2021). Our results offer relevant insights for these regional targeting strategies that—especially following a major external economic shock and to promote short-term recovery—should be focussing on a limited number of selected sectors and in such a way as to ensure an 'alignment' between the existing regional industrial profile and that of inward FDI. In addition, our results shed some critical light on the marked preference of many national and local policymakers for the attraction of manufacturing FDI, based on the idea that this sector would offer the highest local returns, especially in the short run. It is services FDI that, where matched by a supportive regional sectoral profile, can offer the highest short-run returns in terms of recovery of regional productivity.

More research is needed to shed further light on the complex link between global connectivity through FDI and local specialisation patterns in order to reconcile short-term productivity gains (highlighted in our results) with long-term sustainable patterns of regional growth and development. For example, a low degree of diversification may be beneficial for a speedy recovery after a global crisis, but it might also make specialised regions more vulnerable to future shocks in comparison with regions with a higher degree of diversification. Relevant extensions focussing on the long-term implications of heterogeneous short-term recovery patterns should engage with complementary streams of research suggesting that both the regional industrial structure (e.g., Cainelli et al., 2019; Xiao et al., 2018) and internationalisation through trade (e.g., Jordaan, 2023) play a key role as negative shock 'absorber'. In addition, the analysis presented in this paper has focussed on the role of inward FDI in isolation, while an emerging body of work has shown the importance of active internationalisation in the form of outward FDI (Crescenzi et al., 2022) as well as the importance of M&A in addition to greenfield investment (Brakman et al., 2023). Complementarities and synergies between active and passive internationalisation and FDI modes are likely to shape long-term trajectories in a changing and turbulent global landscape.

This paper's focus on the nuanced role of FDI in fostering economic recovery and growth within the EU post-Great Recession aligns with the scholarly and policy narrative on the socio-economic impacts of global crises and megatrends on urban and regional development. These insights are particularly relevant in the light of the current global situation. As cities and regions navigate the complexities of the post-pandemic, geopolitical tensions and

long-term environmental and economic shifts, the strategic attraction and utilisation of FDI emerge as critical levers for resilience and growth (Crescenzi and Harman, 2023). The paper's emphasis on the services dimension of FDI and the importance of sectoral concentration offers a valuable framework for policymakers. It suggests that region-specific attraction policies, which consider the unique industrial profiles and existing assets of regions, can enhance economic recovery and build resilience in the face of ongoing and future crises. Thus, this paper provides actionable insights for regional development strategies in an era of unprecedented challenges and changes.

Endnotes

1 Darvas (2023).

2 FDI inflow figures are drawn from UNCTAD's (2023) '*World Investment Report*'.

3 It is worth clarifying that we interpret 'recovery'—according to an evolutionary perspective (Martin, 2012)—as the capacity of a region hit by a shocking event 'to adapt over the short run' (Cainelli et al., 2019, 756).

4 The *fDi Markets* database presents two main limitations. First, it collects only information on greenfield FDI, while it does not report any data on other types of foreign investments. Second, it collects information on planned future investments. However, regular updates of the database relax this second limitation as investment projects which have not been completed are deleted. Moreover, the reliability of the database is supported by the large number of empirical works which have used it (e.g., Castellani and Pieri, 2016; Crescenzi et al., 2014; Dogaru et al., 2015). It is also worth underlining that analysing the labour productivity returns of inward FDI would benefit from access to a comprehensive and geocoded dataset for both greenfield FDI and Mergers and Acquisitions (M&A). While we plan to explore this in future research, the complexity of M&A transactions exceeds the scope of this paper. M&A deals involve multiple entities, undisclosed values and specific assumptions regarding ownership control over the foreign subsidiary. Indeed, the existing literature in economic geography and regional science often relies on greenfield FDI due to these challenges. In addition, UNCTAD's (2017, 2022) '*World Investment Report*' provides statistical data supporting the importance of greenfield FDI compared to M&A in global investment flows.

5 See, for example, Mullen and Williams (2005) for the derivation of a labour productivity growth equation augmented with inward FDI.

6 The variable defined in Equation (3) shows a correlation coefficient equal to 0.91 with its counterpart defined on the monetary value of the investments received. The correlation coefficient equals 0.93 when the two variables are log-transformed.

7 The two variables capturing regional industrial diversification are defined over six branches available in the Cambridge Econometrics' *European Regional Database*. The six branches include (i) agriculture, (ii) industry (excluding construction), (iii) construction, (iv) wholesale, retail, transport and distribution, communications, hotels and catering, (v) financial and business services and (vi) non-market services.

8 The stocks of foreign-owned and domestic firms are derived from the *ORBIS* databank provided by the Bureau Van Dijk.

9 Tables A1 and A2 in the online appendix report some descriptive statistics of the dependent and the explanatory variables and the correlation matrix among the explanatory variables, respectively. It is also worth underlying that the variables entering the right-hand side of Equation (2) represent only a subset of the many factors that the existing literature has identified as potential drivers of regional resilience—including resilience of EU regions to the Great Recession. Among these, the urbanisation structure of a region (e.g., Brakman et al., 2015; Giannakis and Bruggeman, 2015; Psycharis et al., 2014), the relative importance of medium- and high-tech industries (e.g., Brakman et al., 2015), the degree of industrial specialisation (e.g., Cuadrado-Roura and Maroto, 2016; Palaskas et al., 2015), the degree of industrial relatedness among existing sectors (e.g., Cainelli et al., 2019; Xiao et al., 2018), social capital endowment (e.g., Di Caro, 2014, 2017), as well as regional and national policies (e.g., Crescenzi et al., 2016; Fratesi and Rodríguez-Pose, 2016).

10 Innovation output is measured by patents per million inhabitants; per capita wealth is measured through GDP for the EU regions, while income for the US EAs due to data availability constraints; human capital is measured by the percentage of the population aged 25–64 with tertiary education. EU and US patent data are drawn from the Organization for Economic Cooperation and Development's (OECD) *Regional* database. The other EU data are drawn from the Eurostat's *Regio* database. The other US data are drawn from the *USA Counties Data files* (US Census Bureau) and the *Local Area Unemployment Statistics* (US Bureau of Labor Statistics).

11 It is worth clarifying that we refer to a 'Euclidean distance' because the 'distance'—or 'similarity'—between each EU region and each US EA is defined, with respect to the vector of pre-crisis variables, according to a Euclidean metric. The variables have been mean-standardised to calculate the Euclidean distance because they were defined over different scales.

12 The distance weights enter the computation of the IVs to capture the degree of 'proximity'—based on pre-crisis variables—between each EU region and each US EA. In other words, weights allow us to 'assign' to each EU region the inward FDI dynamic characterising the 'most similar' US EAs.

13 We have tested for potential multicollinearity biases with respect to Equation (2) through the Variance Inflation Factor (VIF). The mean VIF value for Column (5) in Table 4

is 5.82, which is lower than the conservative cut-off value of 10 (Neter et al., 1985).

14 The first-stage multivariate *F* statistic proposed by Sanderson and Windmeijer (2016) represents an improvement of that proposed by Angrist and Pischke (2009) to account for the simultaneous presence of multiple endogenous explanatory variables.

15 The results reported in Table 5 are confirmed when Equation (2) is modified by interacting the two FDI-related variables with a dummy variable taking a value of 1 for regions characterised by a lowly diversified industrial profile, and a value of 0 otherwise—see (Table A3).

16 The null hypothesis of log-normality is not rejected. Therefore, regions have been split around the mean value of the variable capturing the regional share of services employment: regions characterised by a value lower than or equal to the mean have been labelled as production intensive, while regions characterised by a value higher than the mean have been labelled as services intensive.

17 The results reported in Columns (4) and (5) of Table 6 are confirmed when Equation (2) is modified by interacting the two variables for services FDI with a dummy variable taking a value of 1 for services-intensive regions, and a value of 0 otherwise—see Table A4.

18 The Cambridge Econometrics' *European Regional Database* also reports data on two other branches, that is (i) agriculture and (ii) non-market services. However, these two sectoral branches have been excluded from the computation of the 'alignment' index as MNEs did not realise any FDI over the 2004–2014 period.

19 Specifically, the region-specific 'alignment' index takes on 5 possible values: it equals 0 (i.e., 'complete mismatch') if no macro-sector lies in the same quintile of the two distributions; it equals 0.25 if only 1 macro-sector lies in the same quintile of the two distributions; it equals 0.5 if 2 macro-sectors lie in the same quintile of the two distributions; it equals 0.75 if 3 macro-sectors lie in the same quintile of the two distributions; and it equals 1 (i.e., 'complete alignment') if all macro-sectors lie in the same quintile of the two distributions. Thus, the 'alignment' index—in line with a Jaccard index—provides a measure of the number of realised occurrences common to the two sets over the total number of possible common realisations.

20 This exercise is conducted on a reduced sample of 153 regions due to missing Eurostat data on high-tech employment.

21 These exercises are conducted on a reduced sample of 125 regions due to missing Eurostat data on labour productivity for the year 2015.

22 The spatial lags of the inward FDI variables are modelled as exogenous "because their association with the dependent variable is defined through pure geographical distance" (Crescenzi et al., 2022, 68).

23 The robustness test reported in Table A12 is performed on a sample of 113 regions, that is, those which recorded both inward greenfield FDI and M&A. Moreover, data constraints on M&A prevent the construction of reliable IVs in order to perform an endogenous-corrected test.

Supplementary material

Supplementary material is available at *Cambridge Journal of Regions, Economy and Society* online.

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