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The Impact of FDI and Financial Depth on EU Regional Growth: Income and Spatial Heterogeneity

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Abstract

Background and objective: The paper explores the impact of foreign direct investment and financial development on regional growth at the EU regional level for 2005–2017. Both FDI and financial development are important determinants of the regions' growth, but not for all EU regions homogeneously. Some EU regions seem to benefit more than others, depending on certain characteristics, which implies that FDI attraction policies need to bear in mind not only country specificities, but also regional specificities, hence confirming the need for developing FDI attraction policies at the subnational level: financial development, capacity building, and Investment Promotion Agencies are key, for example.

Methods: The methodology used in the paper relies on a beta-convergence model and on fixed effects estimation. In addition, a GMM difference model accounts for endogeneity.

Results: Our empirical findings indicate that, in less wealthy (and more peripheral) regions compared to wealthy regions, FDI productivity spillovers are more significant. In other words, in less wealthy regions, the imitation effect prevails over the competition effect.

Conclusions: FDI and financial development are important determinants of regional growth, especially for less developed and peripheral regions.

Contribution/value: Financial development is shown to be a crucial determinant for economic growth at the regional level, especially for peripheral regions, which raises essential policy implications, especially for the sake of economic disparities in the EU NUTS 2 regions. In other words, local access to finance, especially to bank credit, plays a crucial role for regional growth, despite the continuous integration of financial markets. Also, there is an income and geographic heterogeneity when it comes to estimating FDI spillovers; therefore, the impact of FDI on growth is not always homogeneous across territories, which challenges the idea of simple "bright" or "dark" sides to the effects of FDI.

Keywords: FDI spillovers, Financial depth, Regional growth, Spatial heterogeneity, EU

JEL classification: F23, R11, F30

Introduction

The role of Multinational Enterprises (MNEs) in shaping economic, financial, and institutional paths in the territorial areas they decide to locate has been well scrutinized from both academic and policy perspectives. Academic and policy orthodoxy suggests that MNEs and foreign direct investment (FDI) are channels of scarce capital and potentially positive local externalities for the host economy, such as growth, employment, and productivity spillovers (Blomström & Kokko, 1998; Girma & Wakelin, 2001; Orji et al., 2021). However, despite the extensive empirical literature on FDI spillovers, there is no real consensus on the unconditional benefits deriving from foreign investment for host economies characterized by uneven economic development (Iammarino & McCann, 2013) or "dark-side" outcomes (Phelps et al.,

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2018). The literature has investigated various factors conditioning such spillovers, for example, education, institutional governance, informal institutions, and social capital (Borensztein et al., 1998; Casi & Resmini, 2017; Ogbuabor et al., 2020), primarily focusing on country-level analyses. However, the conditional nature of the impact of FDI is often the most apparent at the subnational level, where regional specificities such as income levels and geographical location can potentially influence the impact of FDI on growth. Hence, examining FDI spillovers at the regional level should account for such heterogeneities.

This paper makes an important contribution to the literature on the geographical impact of FDI. In general, the role of FDI as a determinant of economic growth at the national level has been well established in the academic literature (Blomström & Kokko, 1998; Borensztein et al., 1998). Nevertheless, the exploration of FDI spillovers in a subnational context has been less widespread, mainly due to a lack of data availability. Despite that, recent research has focused on examining the regional dimension of FDI spillovers in the European Union (EU) and highlighted that FDI-induced spillovers can indeed be localized. When Krisztin and Piribauer (2023) estimated the impact of inward FDI on economic growth at the EU NUTS 2 level using a Bayesian spatial autoregressive model and hence accounting for space–time dynamics, it was shown that there is an interdependent spatial relationship between FDI and economic output which indeed proves the mutual effect of FDI on growth. Other studies have revealed that informal institutions, i.e., cultural proximity, social capital, and generalized trust, tend to enhance a region's capacity to absorb FDI spillovers and that the benefits of foreign firms' presence depend on foreign affiliates' country of origin (Casi & Resmini, 2017;[1] Monastiriotis, 2016). Therefore, regional specificities as well as MNEs' ownership features can determine FDI spillover effects, which implies that FDI positive externalities are not always universally beneficial.

Despite the value added, previous research has neglected the varied features of the EU regions, exploring the impact of FDI on regional growth without distinguishing distinct differences in income levels and geographical positioning of regions within EU markets. The novelty of the paper is that it pays attention to regions' specificities and addresses the question: which regions benefit the most from FDI? Richer or poorer? Central or peripheral ones? Identifying a pattern in which less developed and peripheral regions seem to have gained a lot from foreign presence leads to a specific policy formulation where FDI needs to continue being encouraged at the regional level.

In addition, this paper fills a gap in the literature by addressing the role of regional finance in economic growth at the regional level, signifying the importance of local access to finance for growth. So far, financial development has been proven to exert a positive impact on growth at the national level (Alfaro et al., 2004; Durusu-Ciftci et al., 2017; Rajan & Zingales, 1998), while its effect on growth at the subnational level has not been sufficiently explored, which renders this paper quite timely in terms of policy relevance. A large stream of work in economic geography and regional studies is focused on the phenomenon of "financialization" (e.g., French et al., 2011; Pike & Pollard, 2010), but the role of financial institutions in regional growth remains poorly understood. Recently, there has been a shift in paradigm whereby the need for a spatial monetary policy becomes highly relevant for ensuring equal distribution of economic development, especially after the recent Covid crisis. Studies have argued that "financialized economies" (national and regional) can be exposed to external shocks—hence, any spatial dimensions to monetary policy should not be independent from regional development policy (Sokol & Pataccini, 2022).

In order to contribute to this stream of the literature, this paper examines the effect of FDI and financial depth on growth at the pan-European regional level for a time span of 13 years (2005–2017) by testing the moderating role of income level and centrality or peripherality of the region. Using an originally constructed dataset comprising multiple databases (Orbis, Bankscope, Eurostat), it explores the spatial concentration of FDI in the EU regions and the potentially diverse effect of foreign investment on European regions' economic-growth patterns. It also provides one of the first systematic explorations of the role of financial-sector development in determining regional growth patterns.

The paper is organized as follows. Section 1 provides a summary of the theories underpinning the relationship between FDI, finance, and economic growth and an empirical review of the impact of FDI and finance on growth at the regional level. Section 2 presents the geographical distribution of FDI and finance within the EU NUTS 2 (Nomenclature of Territorial Units for Statistics) regions. Section 3 describes the empirical strategy, and Section 4 presents the results. Finally, Section 5 concludes with a summary

[1] The paper dissects the impact of FDI on economic growth using a large European cross-regional sample for 2005–2007 and shows that "FDI-induced spillovers do exist and enhance the economic growth of local economies. Foreign presence, however, is not universally beneficial. Positive spillovers, in fact, are associated with EU-originating foreign firms and FDI in services." (Casi & Resmini, 2017, p. 1500).

of the key findings, suggestions for future research, and implications for policy related to the role of financial development and FDI in regional economic performance.

1 Nexus of FDI, financial development, and economic growth

In the next few sections, the paper develops a structured literature review on the intertwined relationship between FDI, financial development, and economic growth. In particular, we focus on the theoretical framework on the joint and separate impact of FDI and financial development on growth in aggregate terms, then we discuss the impact of FDI and financial development on growth particularly at the regional level, where two subsections dissect the literature on FDI spillovers and growth vs the literature about the impact of financial development on economic growth. Finally, Section 1.3 summarizes.

1.1 Theoretical framework on the impact of FDI and financial development on economic growth

FDI is expected to improve the host economy's technology and increase its total factor productivity, based on the transfer of new technologies and know-how and more efficient production processes based on imitation and greater competition (Casi & Resmini, 2017). Solow's (1956, 1957) seminal work on the theory of economic growth, which was popularized by Sala-i-Martin (1996) for the regional level, portrays FDI as a purely exogenous factor. However, FDI can enhance economic growth via several channels that reach beyond increases in local financial and physical capital endowments. In neoclassical growth models à la Solow (1956), this implies that foreign investment contributes to factor accumulation, which complements local endowments, and technological progress incorporated in the so-called "Solow residual." Romer (1986, 1994) proposed the theory of technological change growth, which considers FDI as part of the key *endogenous* process of human-capital accumulation (attraction of talent by MNE subsidiaries), innovation spillovers (technology transfer from headquarters), and knowledge transfer (MNE which possess superior managerial skills).

FDI-induced spillovers can benefit the host economy through many channels. For example, increased competition forces domestic firms to improve their production efficiency, resulting in productivity gains for the whole region, as suggested by the literature on firm heterogeneity (Barrios et al., 2005). In addition, imitation of new products and processes brought by foreign affiliates allows domestic firms to enhance their productivity and improve their technology through reverse engineering (Glass & Saggi, 2002), and spillovers can be enabled by human capital mobility. Foreign firms tend to require relatively high-skilled labour and usually invest in staff training. As a result, labour mobility from foreign to domestic firms facilitates the transmission of know-how and technologies from the foreign to the domestic firms (Fosfuri et al., 2001). Foreign firms also increase demand for local inputs, which allows direct transfer of technology and know-how to domestic firms (Markusen & Venables, 1999; Rodriguez-Clare, 1996).

Numerous works document how foreign subsidiaries transfer knowledge and technology to host economies through sophisticated and cutting-edge training of employees, contributing to human capital accumulation, technological upgrading, and acquisition of managerial skills (Borensztein et al., 1998). Training can take the form of formal training and induction sessions or on-the-job training in day-to-day activities such as product design or product development (Blomström & Kokko, 1998; Padilla-Pérez, 2008). Training can potentially expand the human capital level in the host economy due to the increased availability of skilled labour for local firms and other institutions such as public bodies, knowledge centres, and consultancies. Highly qualified labour might move to a local research centre or academic establishments to conduct research and share the knowledge acquired from the MNE with local public institutions. Even without this mechanism, everyday human and business interactions among individuals working in similar industries are likely to promote knowledge diffusion (Alfaro et al., 2004).

In addition, local research communities and public organizations may interact with foreign affiliates, enabling exchange of knowledge and information via collaboration or aftercare (Phelps & Fuller, 2001; Young et al., 1994). These collaborative projects may take the form of knowledge exchange programmes, such as MNE managers providing input to universities' taught materials (Padilla-Pérez, 2008), or development of links to facilitate FDI knowledge spillovers (D'Este & Patel, 2007). Positive spillovers may be generated, also, by the independent entrepreneurial endeavours (e.g., spin-offs) of former MNE employees (Padilla-Pérez, 2008).

Lastly, FDI productivity spillovers can occur via horizontal–vertical integration between foreign affiliates and domestic firms. Vertical integration refers to a supplier–buyer relationship between a domestic firm and a foreign affiliate (backward–forward linkage), and investment in higher product quality and technology upgrading results in productivity spillovers.

Knowledge transfer can occur through forward linkages between domestic customers and foreign firms acting as suppliers (Stojčić & Orlić, 2020;[2] Zanfei, 2012). In other words, productivity spillovers can occur through knowledge transfer, higher product quality requirements, and technology upgrading (Mariotti et al., 2015), while forward linkages between domestic customers and foreign suppliers may enable productivity improvements. On the one hand, products, processes, and technologies sold to downstream domestic firms may embody superior knowledge (Orlic et al., 2018), and, on the other, increased competition in upstream sectors may force all input suppliers to increase efficiency, leading to higher quality and cheaper inputs for downstream firms (Markusen & Venables, 1999).

Regarding the role of financial development in economic growth, a strong theoretical background supports the positive link between financial markets and national economic growth. The connection between the financial system and economic growth can be traced back to Schumpeter in 1911. Schumpeter considered the banking system to be a key factor of growth based on its ability to encourage allocation of savings to productive investment and encouragement of innovation (King & Levine, 1993a). Other studies show that advanced financial markets provide firms with access to liquidity and allow them to diversify their portfolios and be entrepreneurial and innovative, stimulating economic growth (Durusu-Ciftci et al., 2017). The financial system can act as a "lubricant" by providing access to capital for firms and encouraging easier flows of funds (Orji et al., 2022), although in some cases a threshold effect has been detected in the finance–growth relationship, whereby beyond a certain threshold, financial development can even be harmful to growth (Law & Singh, 2014).

A well-functioning/well-developed financial system prevents productive enterprises from using their fixed assets as physical collateral when requesting financing from a financial institution. If firms are forced to use physical assets, for example, buildings or machinery, as collateral, this generates a "distortion," which forces the bank to seize these tangible assets in the case of default. In well-developed financial systems, firms can use their intangible assets to guarantee their financial transactions, protecting their physical assets, which can be put to better use to enable R&D or invest in high-margin projects (Rajan & Zingales, 2001). Therefore, it can be argued that the more developed the financial system and the institutions around it, the easier the access to capital for firms will be. This effect is stronger if the host economy is dominated by Small and Medium-sized Enterprises (SMEs), which tend to be more credit-constrained and, thus, more in need of external finance (Palacín-Sánchez & Di Pietro, 2016).

1.2 The impact of FDI and financial development on economic growth at the regional level

1.2.1 FDI spillovers at the regional level in the empirical literature

Despite the theoretical framework provided above, we observe that the focus of analysis has recently shifted progressively to the sub-national level, due to data availability for FDI and the increasing importance of geographical proximity as a channel of positive FDI externalities (Bournakis, 2021). Knowledge transfer and demonstration effects are facilitated by spatial proximity and close social interactions, especially in the presence of non-mobile labour and high transportation costs. In such cases, foreign affiliates might prefer to source their domestic supplies locally and promote MNE embeddedness by forming backward linkages between foreign subsidiaries and domestic firms (Phelps et al., 2003). Subsequently, they can improve knowledge transmission through frequent business interactions, making co-location a necessary but insufficient condition for FDI spillovers (Resmini, 2019; Stojčić & Orlić, 2020).

The availability of reliable and detailed information on FDI inflows at the sub-national level is quite recent. FDI-induced effects depend on several factors, operating at different levels, for example, domestic and foreign firms, local institutions and the firms' environment, and the potential interactions among them. Pecuniary externalities and technological spillovers have different spatial dimensions. The market mediates pecuniary externalities and does not require proximity between the MNE and the domestic firms; however, technological spillovers, which are limited in space and decrease with distance, require proximity (Audretsch, 1998; Keller, 2002). The transmission channels mentioned above have a relevant spatial dimension and are more effective if they involve agglomerated activities (Driffield, 2006; Ottaviano & Thisse, 2004). This implies that co-location is a necessary, but not sufficient condition for the occurrence of FDI-induced effects. Foreign firms prefer to source

[2] Stojčić and Orlić (2020) state: "The improvements in productivity of domestic firms may also come through supplier–buyer vertical interactions with foreign counterparts. Input quality presents competitive advantage for foreign firms for which they may be willing to share technical and managerial knowledge, product design, quality procedures, and financial management experience with domestic suppliers through backward linkages" (p. 1058).

inputs locally to save on transportation costs (Javorcik & Spatareanu, 2011; Rodriguez-Clare, 1996).

Crespo et al. (2009) show that the concept of spillovers is inherently spatial and refers to FDI externalities that likely disseminate initially to neighbouring regions; they also show that the magnitude and direction of FDI externalities depend heavily on regional characteristics. In other words, agglomeration and proximity are essential in estimating FDI spillovers because, as spin-off activity increases, the local employment opportunities for former MNE workers also increase. Moreover, the foreign affiliate is likely to develop linkages with neighbouring industries and local suppliers or distribution companies to minimize transaction costs and foster bilateral communication with the domestic industry and institutional stakeholders such as local chambers of commerce (Driffield, 2006; Monastiriotis, 2016). Therefore, reduced distance and geographical proximity might encourage disseminating FDI benefits to the local economy, especially if the latter has good absorptive capacity.

In this paper we further contribute and add value to the literature by providing an analysis of the impact of FDI on EU regional growth based on a beta-convergence model. A beta-convergence model is considered a convenient framework and is derived directly from the theoretical foundations of the Solow model (Barro & Sala-i-Martin, 1992). It has been used extensively to investigate regional growth in the EU (Monfort, 2008). Previous studies show that human capital formation, agglomeration economies (e.g., urbanization economies), geographical location, infrastructure, and economic structure are important determinants of EU regional economic performance (Boschma et al., 2012; Crescenzi et al., 2016; Crescenzi & Rodríguez-Pose, 2012; Petrakos et al., 2011).

1.2.2 The impact of financial development on economic growth at the regional level in the empirical literature

Several studies find a positive association between financial depth and growth at the country level (Demirgüç-Kunt & Maksimovic, 1998; Durusu-Ciftci et al., 2017; King & Levine, 1993b; Rajan & Zingales, 1998), but few examine the influence of financial depth on *regional* growth. A recent study investigated the impact of regional financial efficiency (allocation efficiency of financial resources) on economic growth in China, and it was shown that financial efficiency is quite heterogenous across the Chinese regions and that there is a threshold effect on the impact of financial efficiency on economic growth (Hu et al., 2019). In a similar vein, Hasan et al. (2009) investigated 147 EU NUTS 2 regions during 1996–2004 and found that higher bank profit efficiency and financial quality improve regional economic growth. Lucchetti et al. (2001) tested the efficiency of the banking sector in the Italian regions during the period 1982–1994. They found that the more efficient the regions' financial institutions (e.g., the greater their ability to allocate credit to the most productive firms), the greater was the impact on regions' economic growth.

While some argue that the deepening of financial markets and the enforcement of creditors' rights are important elements for securing economic growth (Durusu-Ciftci et al., 2017) at the national level, the regions' financialization and regional finance have been increasingly gaining attention as potentially important parameters for shaping the development of uneven spatial trajectories (Sokol, 2017). From a policy perspective, this implies that in times of crises (e.g., the recent Covid crisis and 2008–2009 financial crisis), regions can be left exposed, without a strong banking/financial system to boost growth and sustain private businesses. Therefore, analysts have recently focused attention on the role of policy-making institutions such as central banks in involvement in regional development policies and potential intervention to safeguard territorial cohesion and avoid exacerbating regional disparities (Sokol & Pataccini, 2022).

According to the World Bank Global Financial Development Database (2022),[3] introduced by Čihák et al. (2012) in "Benchmarking financial systems around the world," there are several indicators of financial development. Financial development can be proxied by financial access, depth, efficiency, and stability. Each of these indicators is measured differently. For instance, financial access can be measured as number of bank branches per 100,000 adults in a given country or region; financial depth can be measured as the ratio of bank deposits divided by GDP; financial efficiency can be measured as the bank's return on equity or assets; and financial stability can be measured as the ratio of the bank's non-performing loans to its gross loans.

1.3 Theoretical framework on the impact of FDI and financial development on economic growth: The value added of the paper

In the previous sections we have argued that the macro literature (1.1) and the regional literature (1.2) on FDI, financial development (FD), and growth

[3] https://thedocs.worldbank.org/en/doc/5882f2b2117b882d58a78f9c64ea3613-0050062022/original/20220909-global-financial-development-database.xlsx

should be more connected in order to grasp the complexities of the impact of the former (FDI and FD) on the latter (growth). The overarching theoretical framework can be traced back to the Solow model and the Romer "extension" to endogenous growth theory, whereas an important part of the literature has furthermore tried to assess the existence (absence) or (possibly) irrelevance of spillover effects (horizontally and vertically) from FDI. The literature on FD has developed much earlier, though, focusing on the key element of credit provision and possible bottlenecks. In order to assess such phenomena of the impact of FDI and FD on growth, scholars have looked at different countries, regions, periods, and channels of transmission. Compared to the above-mentioned studies, our study provides an additional insight on the role of finance in EU regional growth for the noteworthy period of 2005–2017, emphasizing a geographical heterogeneity related to the differential impact of finance on growth.

This paper tests whether the period 2005–2017 shows regional convergence/divergence patterns for the 252 EU NUTS 2 regions under study. The EU-24[4] regions exhibit conditional β-convergence when their GDP per capita growth rates are negatively related to their initial income, in other words, when the poorer regions tend to catch up with the wealthier ones in the sample (Barro & Sala-i-Martin, 1992; Sala-i-Martin, 1996). Finally, this paper focuses on regional *financial depth*[5] as a measure of financial development and explores its influence as a driver of regional-level growth. In fact, we clearly define financial depth as the ratio of bank deposits to GDP in each EU NUTS 2 region (see Table A1) and test it as a determinant of growth for 250 EU NUTS 2 regions during 2005–2017.

2 Geographical distribution of FDI and financial depth across EU NUTS 2 regions

How are FDI and financial depth distributed across EU NUTS 2 regions? Using fine-grained maps, we portray the regional distribution of FDI in the EU NUTS 2 regions, by unveiling patterns of foreign-owned firms' and financial-depth concentration. The map of FDI presence is illustrated in Fig. 1 below. Some regions in the EU tend to exhibit a much higher presence of foreign enterprises than others. For instance, West Midlands in the UK[6] has a foreign presence of .4, which means that 40% of that region's turnover stems from foreign firms, based on its major automotive manufacturing cluster (Bryson & Taylor, 2006). Regions in North and South Holland also show high FDI ratios: North Holland includes the capital city, Amsterdam, and South Holland includes industrial city of Rotterdam, which in turn includes the port of Rotterdam, which operates as a trade hub for northwest Europe and has a high concentration of foreign firms.

FDI presence shows a clear metropolitan/periphery pattern—metropolitan regions continue to attract a high volume of foreign-firm activities. In addition, some border regions, especially along the old East–West frontier, seem to attract significant FDI activity. Generally, foreign presence dominates in Central and Eastern Europe (CEE) and the UK and Ireland, implying that FDI activity follows an East–Northwest geographical distribution. Previous studies confirm that some CEE countries, such as Poland, the Slovak Republic, and Czech Republic, have attracted significant amounts of FDI since the 1990s, especially from countries in western Europe, particularly Germany. CEE countries became a popular FDI destination due to geographical proximity to the investor countries, a skilled and inexpensive labour force, political stability, and prospective EU membership (Pavlínek, 2004). This is confirmed by the fact that after the fifth EU enlargement in 2004 and 2007, FDI seemed to preferentially locate on the border regions of the CEE countries ("West–East border effect"), which were characterized by lower production costs and could benefit from abolished border checks, due to the EU integration (Serwicka et al., 2022).

Although countries in south and western Europe (especially Greece, Italy, and Portugal) are not significant recipients of foreign activity compared to the CEE[7] countries, certain non-metropolitan regions have a strong FDI presence (e.g., Sterea Ellada in Greece, Aragon and Asturias in Spain). This somewhat "inflated" indicator might be attributable to the method used to measure FDI presence: foreign firms' turnover over total turnover in the same year. This

[4] Denmark, Croatia, and Cyprus are excluded from the analysis because we have insufficient information on Danish regions. Croatia joined the EU in 2013, and Cyprus FDI data could be "over-inflated" due to Russian investment in shell companies.
[5] Unfortunately, Bankscope does not provide sufficient data to allow the construction of other financial development variables.
[6] As of February 2020, UK has no longer been a member of the European Union.
[7] CEE seems to have attracted higher amounts of FDI vis-à-vis other regions during the 2010 to 2017 time period. This might be related to the reverse capital flows that occurred after the 2008 financial crisis, which induced many foreign firms, including banks, to repatriate their capital, i.e., outward capital flows (Mihaljek, 2010). It is likely, also, that the repatriation of foreign banks' assets caused a credit contraction in the CEE countries and affected MNCs' subsequent location decisions to decrease foreign affiliates' turnover. Also, the high dependence of CEE countries on inward FDI from western Europe and, especially, Germany, might have exposed CEE countries to macroeconomic shocks occurring in western Europe and might be responsible for the evident decrease in FDI in CEE after the 2008–2009 financial crisis, which was the result of a contraction in production in western Europe.

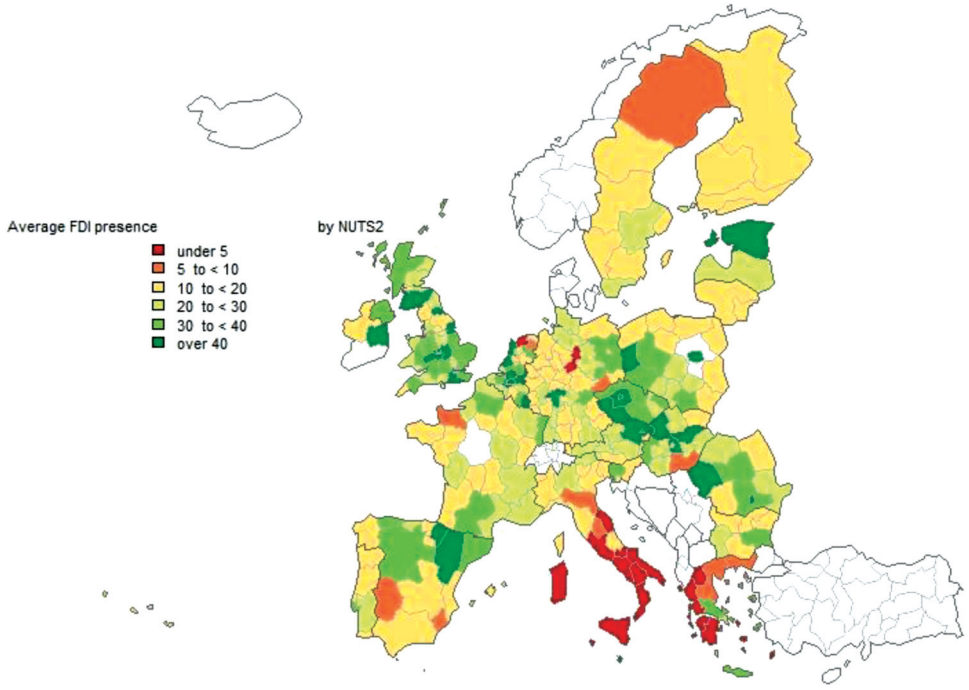

Fig. 1. FDI presence (EU NUTS 2) for 2005–2017. Source: Authors' calculation.

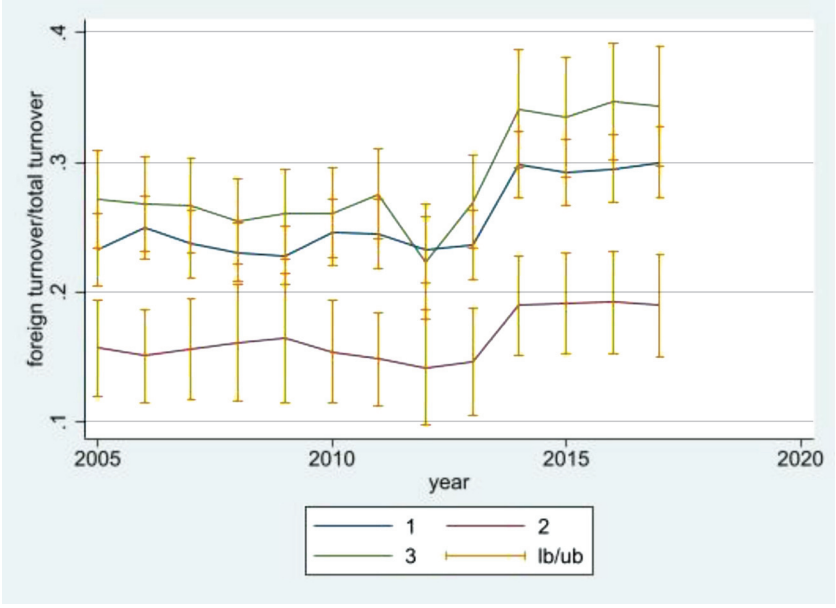

Fig. 2. EU NUTS 2 FDI presence by GEO group[8] (2005–2017). Source: Authors' calculation.

ratio may be large if the NUTS 2 region has relatively low levels of total economic activity (denominator) and, simultaneously, attracts only a few foreign firms with high turnover (numerator).

Fig. 2 illustrates the FDI patterns developed through time for the three different geographical groups of NUTS 2 regions. Overall, it is evident that after 2012–2013 all regions experience a reversal of downward FDI trend, attributed to the economic crisis. FDI presence seems to be the lowest in the South EU regions and has the lowest fluctuations over time. A slight rise of FDI is observed between 2014–2015

[8] FDI presence by group of regions: 1 (Northwest), 2 (South), 3 (CEE).

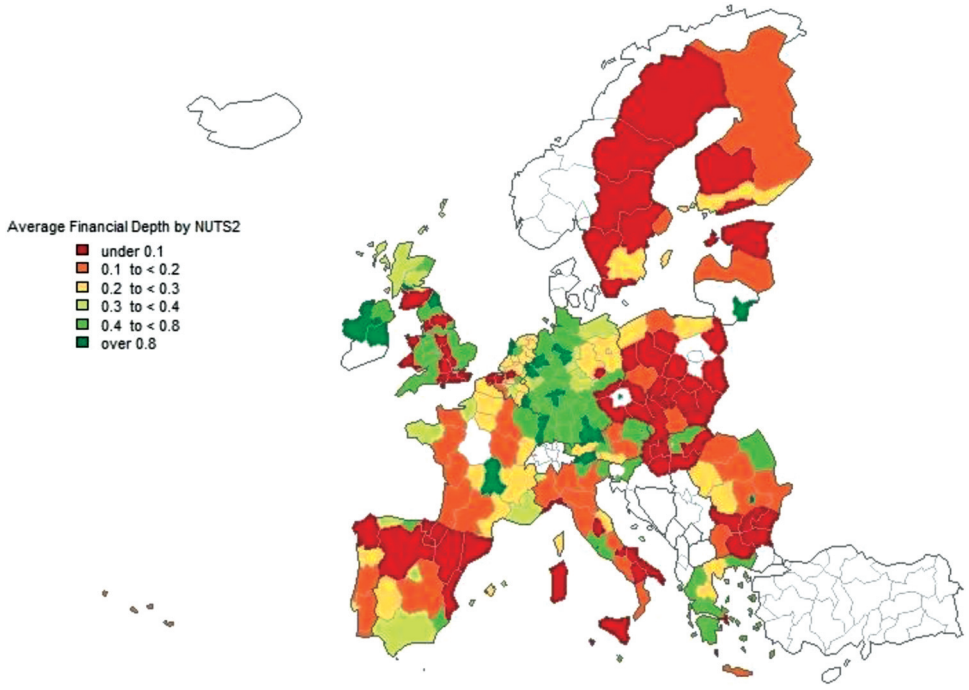

Fig. 3. Financial depth (EU NUTS 2) for 2005–2017. Source: Authors' calculation.

and afterwards it is rather stable (until 2017). The CEE group of regions seems to attract the highest FDI among the three groups of regions and it also seems to face the highest fluctuations of FDI presence, especially from 2013 onwards. This might be related to the reverse capital flows that occurred after the crisis and induced many foreign firms (including banks) to repatriate their capital and cause outward capital flows (Mihaljek, 2010). Moreover, the high dependence of the CEE countries on inward FDI from Western Europe and especially from Germany might have rendered the CEE countries vulnerable to macroeconomic shocks occurring in Western Europe and hence might be responsible for the evident decrease of FDI occurring in CEE after the 2008–2009 financial crisis, as an aftermath of the contracted production in Western Europe. For instance, the FDI stock in the automotive industry in the CEE countries experienced a temporary decrease during the years of the economic crisis, reaching its lowest point in 2011 but slowly recovering in 2012, exhibiting large fluctuations stemming from the changes in automotive FDI stock in Hungary and from the declining investment from Western European companies (Pavlínek, 2015). Finally, the Northwest group of regions exhibits a fluctuation of FDI similar to the CEE regions, due to the resurgence of economic activity after the financial crisis.

The mapping of financial depth in Fig. 3[9] shows that, except for a large part of Germany, Austria, Ireland, and some parts of the UK, few regions have high levels of financial depth. The high levels reported for the UK and Ireland can be explained by the fact that the former is a world-level financial centre and the latter is a country with a high presence of FDI net inflows. The next ranked areas for financial depth are regions in Germany and the Benelux area, which represents the heart of EU economic activity with significant industrial and financial centres considered safety nets for deposits in Europe. Except for some peripheral regions in the south of the EU, metropolitan regions appear to have higher levels of financial depth. This might be due to unrecorded activity (shadow economy).

3 Methodology

The present paper explores two specific phenomena which have received scant attention so far as determinants of regional economic performance: foreign firms' presence (FDI) and financial depth of the region. These factors are included as economic-growth explanatory variables in an extended beta-convergence model. Relying on a beta-convergence framework at the regional level, where regional GDP per capita growth rate is regressed on the initial

[9] Calculated as bank deposits divided by GDP for each NUTS 2 region (see Table A1 for a definition).

regional GDP per capita level, we employ a specification completely in line with the seminal papers by Crescenzi and Rodríguez-Pose (2012) and Crescenzi et al. (2016) and estimate the following equation:

$$\begin{aligned}\Delta logGDPpc_{it} = a &+ \beta_1 LogGDPpc_{\mathrm{it}-1} + \beta_2 LogFDI_{\mathrm{it}-1} \\ &+ \beta_3 LogFIN\text{-}DEPTH_{\mathrm{it}-1} \\ &+ \beta_4 Log(INTERACTIONS)_{\mathrm{it}-1} \\ &+ \beta_5 LogCONTROLS_{\mathrm{it}-1} \\ &+ RegionFE + TimeFE + u_{\mathrm{it}}\end{aligned} \tag{1}$$

where i takes values between 1 and 252 for the EU regions, t takes values from 2005 to 2017, and a is the constant term. In other words, the dependent variable $\Delta logGDPpc_{\mathrm{it}} = logGDPpc_{\mathrm{t}} - logGDPpc_{\mathrm{t}-1}$ is the annual change of the logarithm of GDP per capita (at constant 2010 prices) in region i and $LogGDPpc_{\mathrm{it}-1}$ measures the logarithm of lagged GDP per capita, which can be interpreted as the "convergence" explanatory variable. When the sign of the coefficient β_1 is negative, this signifies that the countries with a relatively lower Gross Domestic Product per capita grow faster. In fact, the annual difference of the log of GDP is an excellent proxy of the growth rate of the level of development we wish to capture, and in the results section we show that this is indeed the case. Finally, β_2 and β_3 are respectively the coefficients of the lagged main explanatory variables (log of FDI and FIN-DEPTH), and β_4, β_5 are the coefficients of the interaction terms (exploring moderation channels) and a vector of control variables, respectively. All the models include region and time fixed effects, and u_{it} is the idiosyncratic error term. We rely on such specification to explicitly capture the cross-country variation levels of FDI and FIN-DEPTH on the growth of level of development. Had we used the deltas of the independent variable, we would have departed from the convergence model specification.

A delayed effect and endogeneity might characterize the relationship between GDP per capita growth and all the explanatory variables. Following the approach of previous studies on beta-convergence using dynamic panel data models (Badinger et al., 2004; Crescenzi et al., 2016; Elhorst, 2010), we employ the GMM estimator in first differences as was introduced by Arellano and Bond (1991). Therefore, as a robustness check, we constructed a fixed effects (FE) model with region dummies and time-lagged independent variables (t − 1) and a General Methods of Moment (GMM) difference model (Arellano & Bond, 1991; Blundell & Bond, 1998). The first differenced dependent variable is the growth variable (*GDPpc).*

FDI is calculated as: $\frac{\text{Foreign Firms' Turnover}}{\text{Total Turnover}}$ at the NUTS 2 aggregation level.[10] EU NUTS 2 data on FDI were constructed from firm-level data aggregated at the regional level using the Bureau van Dijk Amadeus database.[11] After aggregating the firm-level data from Amadeus at the regional level (NUTS 2), the panel dataset contains observations on foreign affiliate presence for 252 EU NUTS 2 regions for 13 years during 2005–2017. FIN-DEPTH measures financial depth and is calculated as: $\frac{\text{Banking Deposits}}{\text{GDP nominal}}$ at the NUTS 2 aggregation level.[12]

The vector CONTROLS includes four explanatory variables, which are analysed below. To take account of the level of centrality or peripherality of the EU NUTS 2 regions, we use the gravity index (GRAV). The gravity index is defined as the inverse of the sum of distances among the centroids of each pair of regions weighted by the region's population. It is measured as: $\sum_i^j (\frac{PiPj}{Dij})$, where P is the population of region i and all other European regions j, and D is the distances between them (Petrakos et al., 2011). The gravity index takes values greater than (or equal to) 0. The higher the value of the gravity index, the more central the region's position in the EU space, the better its accessibility, and the greater its market potential.

R&D expenditure is measured as public R&D expenses per inhabitant (see definition in Table A1), and it has been fully recognized as a key determinant of long-run growth (Frenken et al., 2005; Fu, 2008). The capital–labour ratio measures gross fixed capital formation divided by labour (see definition in Table A1) and builds on Solow's growth theory (Solow, 1956, 1957; see also Boschma et al., 2012). Population density measures the number of inhabitants per square metre (see definition in Table A1) and is included as a standard control variable to account for rapid patterns of urbanization (Fujita & Thisse, 1996). The literature has extensively used the

[10] An alternative measure would be the number of foreign firms in the total number of firms. However, this would greatly underestimate FDI presence: the average size of foreign firms (based on turnover or employment) is much higher than the average size of domestic firms.

[11] We use Amadeus data which include micro and small enterprises. Operating revenue (turnover) is used to compute the ratio. To derive the FDI variable, we first distinguish between foreign and domestic firms: we consider a firm to be foreign if its country of residence is different from the country of the global ultimate owner and if the percentage of foreign ownership exceeds 10% of the firm's total shares. Then we divide foreign-firm turnover by total regional turnover.

[12] To construct the variable FIN-DEPTH, we use Bankscope data. We employed unconsolidated Bankscope data for bank customer deposits at the EU city level and aggregated them to the EU NUTS 2 level. The World Bank Global Financial Database has defined several other indicators for measuring financial depth such as a) Liquid liabilities to GDP (%), b) Central bank assets to GDP (%), c) Stock market capitalization to GDP (%), and d) Deposit money banks' assets to GDP (%), but Bankscope did not provide sufficient data for these proxies and therefore we could not use them.

Table 1. Baseline regressions (OLS with region and time dummies).

	(1) Full	(2) Full	(3) Full	(4) Full	(5) Less Developed	(6) More Developed	(7) Full	(8) Less Developed	(9) More Developed
GDPpc (−1)	−0.222***	−0.208***	−0.220***	−0.221***	−0.230***	−0.365***	−0.220***	−0.229***	−0.364***
	(0.021)	(0.020)	(0.021)	(0.021)	(0.027)	(0.032)	(0.021)	(0.027)	(0.033)
FDI (−1)	0.038**		0.043**	0.116*	0.213***	−0.035	0.042**	0.060**	0.025
	(0.017)		(0.017)	(0.060)	(0.059)	(0.066)	(0.017)	(0.027)	(0.018)
FIN-DEPTH (−1)		0.028***	0.029***	0.029***	0.070***	0.002	0.077***	0.042	0.022
		(0.009)	(0.009)	(0.009)	(0.013)	(0.007)	(0.021)	(0.050)	(0.022)
FDI (−1) # Gravity (−1)				−0.025	−0.055***	0.020			
				(0.018)	(0.019)	(0.019)			
FIN-DEPTH (−1) # Gravity (−1)							−0.015***	0.010	−0.006
							(0.005)	(0.017)	(0.005)
Gravity (−1)	−0.351*	−0.374*	−0.355*	−0.353*	−0.321	−1.036***	−0.348*	−0.324	−1.012***
	(0.205)	(0.214)	(0.205)	(0.204)	(0.200)	(0.268)	(0.204)	(0.202)	(0.271)
R&D (−1)	−0.006	−0.013**	−0.010	−0.009	−0.009	0.008	−0.010	−0.010	0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)	(0.009)
Capital/Labour (−1)	−0.023***	−0.021**	−0.024***	−0.024***	−0.017*	−0.037**	−0.024***	−0.016	−0.036**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)	(0.018)	(0.008)	(0.010)	(0.018)
Pop. Density (−1)	0.116	0.186	0.126	0.132	0.038	0.723***	0.130	0.027	0.717***
	(0.195)	(0.204)	(0.195)	(0.194)	(0.194)	(0.242)	(0.194)	(0.196)	(0.240)
Constant	3.012***	2.591***	2.975***	2.941***	3.184***	3.526***	2.933***	3.240***	3.470***
	(0.502)	(0.507)	(0.498)	(0.497)	(0.587)	(0.648)	(0.499)	(0.587)	(0.651)
Observations	2,613	2,623	2,552	2,552	1,266	1,286	2,552	1,266	1,286
Number of NUTS 2	252	249	248	248	152	151	248	152	151
Adjusted R-squared	0.479	0.473	0.487	0.487	0.565	0.491	0.488	0.564	0.491
Regions FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Years FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

variables mentioned above to estimate long-run or short-term convergence trends in the EU regions (Barrios et al., 2005; Fujita & Thisse, 1996; Ottaviano & Puga, 1998; Petrakos et al., 2011).

Finally, the vector INTERACTIONS includes FDI*GRAVITY and FIN-DEPTH*GRAVITY and is aimed at measuring the respective conditional impacts of FDI and FIN-DEPTH on economic growth.[13]

4 Empirical results

Table 1 presents the estimation results of the baseline fixed effects (FE) model with region and time dummies. The first three columns explore the impact of FDI and FIN-DEPTH on regional economic growth. Columns 4 to 6 focus on the role of gravity as a potential moderating factor in the FDI–growth nexus, for the overall sample (column 4), the sample of less developed regions (column 5), and the sample of more advanced regions (column 6). Columns 7 to 9 present the result for the role of gravity as a potential moderating factor in the FIN-DEPTH–growth nexus in the overall sample (column 7), the sample of less developed regions (column 8), and the sample of more developed regions (column 9).[14] Based on the interaction between FDI*GRAVITY and FIN-DEPTH*GRAVITY for the different samples, we can estimate the impact of income and spatial heterogeneity of FDI and FIN-DEPTH. The interactions of FDI*GRAVITY and FIN-DEPTH*GRAVITY provide information on whether the centrality/peripherality of each region magnifies the respective impacts of FDI and financial depth on regional growth.

First, all the columns in Table 1 show that the coefficient of $GDPCAP_{t-1}$ is statistically significant and negative, indicating that, during 2005–2017, the poorer EU NUTS 2 regions were converging towards

[13] All regressions include region- and year-fixed effects (FE), and the GMM-DIFF modelling strategy (Arellano & Bond, 1991; Blundell & Bond, 1998) tests for endogeneity and omitted variables bias. Tables A2 and A3 present the summary statistics and correlations.
[14] Less (more) advanced regions are defined as regions with lower (higher) average per capita GDP (sample average GDP per capita € 25,473). The Appendix, Table A4, presents the list of less and more developed regions.

the wealthier ones (confirming the beta-convergence hypothesis). The value of the coefficient of lagged GDP per capita is in the range 0.20–0.36 log points, meaning that the speed of convergence is weak, that is, poorer EU regions are converging only slowly towards the wealthier ones.

FDI and FIN-DEPTH have a positive impact on GDP per capita growth (columns 1, 2, and 3); therefore, regional FDI presence and financial depth contribute positively to regional growth. But how do income heterogeneity and gravity moderate this positive impact? The opportunity to explore the level of the regions' development as a possible conditional factor in FDI spillovers stems from the fact that our analysis includes a very diverse sample of regions in terms of per capita GDP. Also, the geography of the EU shows the presence of very heterogeneous regions: for example, large centrally located markets (in terms of potential measured by population) and small markets (scarcely populated) in more peripheral areas.

In the regression that includes only less developed regions in the EU (column 5), the impact of FDI is positive, but is moderated negatively by gravity: this means that more peripheral and less wealthy regions benefit relatively more from higher levels of FDI (negative coefficient of the interaction). However, we can appreciate that it is not the case for the sample of more developed regions (column 6). Column 7 also shows that the impact of financial depth is positive for the full sample but again is moderated negatively by gravity,[15] meaning that peripheral regions—regardless of the level of development—benefit relatively more from higher levels of FIN-DEPTH. In other words, peripherality in the EU is not a barrier to the benefits deriving from foreign investment and financial markets alike. This is an important result in the literature on the role of financial development in Europe from a regional perspective.

We have run a robustness check for the possibility that both FDI and FIN-DEPTH are affected by endogeneity. We have employed a GMM difference one-step robust model[16] that suits regional level data (see Crescenzi & Rodríguez-Pose, 2012). The GMM-DIFF regression results are presented in Table 2. The results of the baseline model are mostly confirmed, with the exception of the lack of significance of the FIN-DEPTH variable and its interaction with gravity (column 7). We interpret this as further confirmation that FDI, compared to internal finance, boosts regional economic growth more and might be channelled through the same positive spillovers.[17] For each regression we report the *p*-value of the Sargan test, the Hansen test, and the cross-sectional dependence test developed by Friedman (De Hoyos & Sarafidis, 2006) to rule out endogeneity and cross-sectional dependence, respectively.[18]

Our empirical findings indicate that, in less wealthy (and more peripheral) regions, compared to wealthy regions, FDI productivity spillovers and knowledge externalities, arising from proximity to foreign investors, are more significant. In other words, in less wealthy regions, the imitation effect prevails over the competition effect, and perhaps the larger the technological gap between local and foreign firms, the more local firms can learn to increase their productivity (Meyer & Sinani, 2009). The coefficient of FIN-DEPTH, which estimates the effect of local financial depth on regional growth, is generally positive and statistically significant, indicating that better-developed regional financial markets boost economic performance. This finding is important as it illustrates that even though capital markets are currently globalized, financial intermediation at the local level and access to local capital still matters, especially for less advanced regions (Cavallaro & Villani, 2022).

Concerning the control variables, the region's position on the EU map and its distance from markets (expressed by the gravity index) seem to have a negative direct effect on growth due, perhaps, to the fact that peripheral regions grew more than centrally located regions in the time period considered (Bruno & Cipollina, 2018).[19] Furthermore, a non-linear effect drives the negative result for R&D expenditure.[20] The capital–labour ratio, used to proxy for capital intensity, seems to be another indicator of convergence: the lower the initial level of the capital-to-labour ratio, the higher the growth potential (Boschma et al., 2012; Frenken et al., 2005). Finally, increased population density—linked indirectly to economies of scale—seems also to contribute to regional growth (Fujita & Thisse, 1996; Ottaviano & Puga, 1998).

To sum up, the above findings suggest that FDI and FIN-DEPTH are important determinants of regional

[15] The lack of significance of FIN-DEPTH (results in columns 8 and 9) is driven also by limited statistical power; the last two regressions include only half the total number of observations.
[16] We have adopted "orthogonal" transformation of the missing value to achieve more efficient use of statistical power.
[17] The (very marginally) significant result for the interaction between FIN-DEPTH and gravity (column 8) does not change the overall pattern of results and, again, may be driven by the reduced number of observations.
[18] We would like to thank one referee for this suggestion. The use of the Friedman test is appropriate in this context due to the relatively unbalanced nature of the panel, where the Peasaran and Frees tests are less powerful (De Hoyos & Sarafidis, 2006).
[19] This is depicted in the Appendix, Fig. A1.
[20] The table is available upon request.

Table 2. GMM-DIFF (one-step robust orthogonal).

	(1) Full	(2) Full	(3) Full	(4) Full	(5) Less Developed	(6) More Developed	(7) Full	(8) Less Developed	(9) More Developed
GDPpc (−1)	−0.308***	−0.321***	−0.315***	−0.314***	−0.337***	−0.407***	−0.316***	−0.344***	−0.405***
	(0.031)	(0.035)	(0.034)	(0.034)	(0.039)	(0.054)	(0.034)	(0.038)	(0.055)
FDI (−1)	0.074**		0.109***	0.299**	0.245**	0.097	0.108***	0.051	0.007
	(0.035)		(0.037)	(0.125)	(0.115)	(0.153)	(0.035)	(0.038)	(0.050)
FIN-DEPTH (−1)		0.110***	0.113***	0.111***	0.114***	0.005	0.122	0.023	0.017
		(0.025)	(0.026)	(0.027)	(0.019)	(0.013)	(0.095)	(0.046)	(0.037)
FDI (−1) # Gravity (−1)				−0.065*	−0.070*	−0.030			
				(0.039)	(0.038)	(0.040)			
FIN-DEPTH (−1) # Gravity (−1)							−0.003	0.035*	−0.003
							(0.035)	(0.021)	(0.009)
Gravity (−1)	−2.818***	−3.232***	−2.937***	−2.899***	−2.863***	−1.880***	−2.925***	−2.915***	−1.883***
	(0.560)	(0.659)	(0.624)	(0.633)	(0.659)	(0.675)	(0.592)	(0.637)	(0.677)
R&D (−1)	−0.017	−0.034***	−0.026**	−0.027**	−0.023**	0.013	−0.026**	−0.021**	0.013
	(0.011)	(0.012)	(0.011)	(0.011)	(0.010)	(0.015)	(0.010)	(0.010)	(0.015)
Capital/Labour (−1)	0.004	0.018	0.008	0.008	0.010	−0.002	0.008	0.014	−0.003
	(0.014)	(0.016)	(0.015)	(0.015)	(0.016)	(0.021)	(0.015)	(0.017)	(0.021)
Pop. Density (−1)	2.624***	3.059***	2.748***	2.726***	2.592***	1.764***	2.738***	2.646***	1.753**
	(0.571)	(0.664)	(0.630)	(0.637)	(0.700)	(0.684)	(0.607)	(0.672)	(0.681)
Observations	2,013	2,033	1,971	1,971	989	982	1,971	989	982
Number of NUTS 2	245	243	242	242	145	142	242	145	142
ar1p	0	0	0	0	4.34×10^{-9}	1.04e-09	0	5.52e-09	9.51e-10
ar2p	0.000126	0.000498	0.000715	0.00100	1.68e-05	0.00988	0.000715	1.14e-05	0.00779
Sargan p-v	0	0	0	0	0	0	0	0	0
Hansen p-v	0.979	0.953	0.975	0.980	1.000	1.000	0.973	1.000	1.000
CSD(Friedman) p-value	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
N	2013	2033	1971	1971	989	982	1971	989	982
j	300	287	296	296	266	289	296	266	289

Robust standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. FDI and Finance considered as endogenous, IV second lag. All other variables considered as not-strictly exogenous and instrumented with internal IV (from first lag) and external instruments.

growth, especially for less developed and peripheral regions. The greater growth impact of FDI and FIN-DEPTH on regions with low and modest levels of development can be attributed to the fact that less developed EU regions, having less capital in general, and less foreign capital in particular, have more margin to learn new things and absorb new technologies from foreign investors, whereas advanced regions have already established their production patterns and might not have much to gain from a foreign investor. For instance, for less wealthy regions, a foreign investor could contribute more added value to their existing economic structure than in economically and technologically mature economies.

5 Discussion and policy implications

This paper confirms the existence of a relevant income and spatial heterogeneity when estimating the impact of foreign direct investment and financial depth on growth at the EU regional level. The main value added of the paper is the exploitation of a purpose-built detailed regional dataset, which has enabled us to estimate FDI spillovers at the regional level, thereby filling a gap, given that the literature has mostly focused on identifying the FDI and financial-depth impact at the national, sectoral, or firm level (Bruno & Cipollina, 2018; Nicolini & Resmini, 2010). The paper has shed light on foreign affiliates' role in determining regional economies' growth trajectories in an EU context and has explored whether FDI spillovers occur in a homogenous or heterogeneous way across geographical territories. Our analysis shows that those regions that seem to absorb the most externalities stemming from the presence of foreign affiliates are the less wealthy (and often peripheral) EU regions. This finding could challenge the argument that spatial concentration of FDI could exacerbate regional disparities or cause crowding-out effects (Lee et al., 2022). Furthermore, the heterogeneity identified challenges relating to the idea of simple bright or dark sides to the effects of FDI and highlights the essentially empirical nature of the issue and the necessity for contextualized policy interventions (Phelps et al., 2018). Therefore, in the context of FDI spillovers, the intra-national heterogeneity of

EU regions and the core–periphery patterns seem to benefit the less advanced EU areas disproportionately more, implying that these regions have more to gain from foreign investment. This result is in line with previous research on the spatial heterogeneity of within-country or cross-country FDI spillovers (Crespo et al., 2009; Monastiriotis, 2016; Monastiriotis & Jordaan, 2010; Xu & Sheng, 2012); however, it provides a unique insight into the intra-national heterogeneity of FDI spillovers in the EU regions. Policy-wise, this evidence sheds new light on the design of regional development policy by confirming that sub-national Investment Promotion Agencies (IPAs) have indeed an important task to fulfil, by potentially prioritizing less advanced and peripheral regions in terms of FDI attraction, where information asymmetries and institutional weaknesses can be stronger (Crescenzi et al., 2021).

Another key contribution of the paper is the exploration of financial development as an important determinant of regional growth and the potential heterogeneity impact across EU regions. Regional finance is shown to positively affect regional growth; in particular, peripheral EU regions seem to benefit more from a developed regional financial system. These regions generally include mostly small firms (or SMEs) that do not have easy access to global/national capital markets and have to rely more on the local banking system to access finance. In other words, the paper offers a unique insight to the territorial dimension of financial development as a growth determinant, despite the EU's continuous financial integration and globalization, and highlights that access to finance also matters for regional economies. This calls for considering that among the physical and commercial infrastructures that are known to be determinants of both the location of FDI and its spillovers, much more information is required on the role of financial institutional development above and beyond physical and commercial infrastructures as a potential future, *explicit policy focus*. In other words, while the possibilities for regional-level institutions to affect the embeddedness of and spillovers from MNEs have been explored (Crescenzi et al., 2021; Phelps et al., 2003; Young et al., 1994), regional financial-sector development policies have been overlooked so far. For instance, the institutional and monitoring role of regional financial institutions should be enhanced, as part of sub-national or national development policy, sustaining their capacity to act as "lubricants" of the local economy. To go one step further, having seen the importance of regional finance for the peripheral regions of the EU, one could argue that "regional financialization" (on the institutional and capacity-building side) could progressively become a pillar/objective of governments' development policy through potential government subsidies. In parallel, current EU financial instruments such as guarantees, subsidized loans, and equity financing, targeting mostly SMEs, could be further reinforced in order to address market failures and information asymmetries in the EU periphery. Lastly, one could argue that a spatial monetary policy could be deployed (via central banks) to ensure easier access to finance at the regional level. Consequently, the paper re-captures the essential role of regional development policy, both in helping less developed regions to attract foreign direct investment and addressing market distortions arising from lack of access to finance.

We would like to conclude with some suggestions for future research. Future scholars could ground some of the aggregate regional-level findings in this paper in firm-level quantitative and qualitative analyses, drawing on insights from the financial, FDI policy, MNE, and SME communities. More detailed and context-specific knowledge about how firms access finance, from which financial institutions, via which business - service intermediaries, and with what effect would help to inform policy interventions designed to promote regional growth. More generally, any "new" industrial or regional strategies in Europe should be framed as both vertically and horizontally integrated, place-sensitive development policies. In other words, "a coherent industrial strategy at various levels of governance, whether regional and/or national" (Crescenzi & Iammarino, 2017; Iammarino, 2018) should tackle individual and social isolation across geographical space (the periphery is still the underdog). Identification of the subnational dimensions to these structural transformations has been advanced significantly by academic research at the intersection of international business studies and economic geography. However, a rethinking of regional development from this perspective continues to present challenges in terms of policy design, and beyond a sole focus on maximization of FDI spillovers and over-reliance on FDI strategies that disregard the level of MNEs' embeddedness (Zoltán & Gábor, 2022). Place-sensitive industrial connectivity policies require territorial differentiation within both the core and peripheral regions, and across and within regions in the same country.

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Appendix

Table A1. Description of variables.

Name	Indicator	Type	Definition	Source	Reference
Regional GDP growth rate %	Regional Economic Development	Dependent	$\frac{GDPCAPt - GDPCAPt-1}{GDPCAPt-1}$ NUTS 2	Eurostat Regional statistics by NUTS classification	World Bank
Initial GDP/capita	Initial level of economic growth	Independent	$GDPCAP_{t-1}$ (NUTS 2)	Eurostat Regional statistics by NUTS classification	Barro and Sala-i-Martin (1992); Solow (1956)
Foreign affiliates' presence (NUTS 2)	FDI	Independent	$\frac{\text{Foreign Firms'Turnover}}{\text{Total Turnover}}$ NUTS 2	Amadeus	Meyer and Sinani (2009); Monastiriotis and Jordaan (2010)
Financial Depth	Financial depth	Independent	$\frac{\text{Banking Deposits}}{\text{GDP nominal}}$ NUTS 2	Bankscope & Eurostat	Čihák et al. (2012)
Gravity	Centrality & Accessibility	Independent	$\sum_i^j (\frac{pipj}{dij})$NUTS 2	Eurostat; GISCO	Petrakos (1996)
Population Density	Agglomeration economies	Independent	Inhabitants per square meter (NUTS 2)	Eurostat Regional statistics by NUTS classification	Petrakos (1996)
Capital−Labour Ratio	Capital Intensity	Independent	$\frac{\text{Gross Fixed Capital Formation}}{\text{Employment}}$ NUTS 2	Eurostat Regional statistics by NUTS classification	Solow (1956)

Table A2. Summary statistics.

Variable	Observations	Mean	Std. Dev	Min	Max
GDP per capita growth	2,552	0.021046	0.06111	−0.25256	0.292501
GDP per capita	2,552	25473.06	11865.36	2400	65400
Foreign Presence	2,552	0.237451	0.160246	0	1
Financial Depth	2,552	0.342477	0.585716	$4.76E^5$	12.02749
"Gravity"	2,552	26.36502	27.59608	1.644867	249.7496
Research and Development	2,552	468.9388	522.3606	0	3884.3
Capital Labour Ratio	2,552	147082.9	91613.28	13601.4	964864.9
Population Density	2,552	397.529	937.6592	3.3	11357.1

*Table A3. Correlation table (SE in parenthesis, *** 1% significance).*

	GDP per capita growth	GDP per capita	Foreign Presence	Financial Depth	"Gravity"	Research and Development	Capital Labour Ratio
GDP per capita	**−0.0491*** (0.0064)**	1					
Foreign Presence	**0.0873*** (0.000)**	**0.1218*** (0.000)**	1				
Financial Depth	0.0011 (0.9511)	**0.2647*** (0.000)**	**0.0604*** (0.0007)**	1			
"Gravity"	0.0072 (0.6901)	**0.2647*** (0.000)**	**0.1574*** (0.000)**	**0.0834*** (0.000)**	1		
Research and Development	−0.0054 (0.7737)	**0.7055*** (0.000)**	**0.1076*** (0.000)**	**0.2113*** (0.000)**	**0.1819*** (0.000)**	1	
Capital Labour Ratio	**−0.0693*** (0.0003)**	**0.4999*** (0.000)**	0.0124 (0.4962)	**0.1243*** (0.000)**	**0.1983*** (0.000)**	**0.3264*** (0.000)**	1
Population Density	0.0061 0.736	**0.0539*** (0.002)**	-0.0265 (0.1309)	-0.0222 (0.2057)	**0.4081*** (0.000)**	**0.1277*** (0.000)**	**0.0877*** (0.000)**

Table A4. Less developed and developed regions.

Regions with lower-than-average GDP per capita	Regions with higher-than-average GDP per capita
Abruzzo	Alsace
Alentejo	Aquitaine
Algarve	Arnsberg
Anatoliki Makedonia Thraki	Auvergne
Andalucía	Basse-Normandie
Aragón	Bedfordshire
Attiki	Buckinghamshire
Basilicata	Berlin
Brandenburg	Bourgogne
Bucuresti	Bratislavský kraj
Budapest	Braunschweig
Burgenland	Bremen
Calabria	Bretagne
Campania	Cataluña
Cantabria	Centre
Castilla Leon	Champagne-Ardenne
Castilla-la Mancha	Cheshire
Centro (PT)	Comunidad Foral de Navarra
Centru	Comunidad de Madrid
Chemnitz	Corse
Ciudad Autónoma de Ceuta (ES)	Cumbria
Ciudad Autónoma de Melilla (ES)	Darmstadt
Comunidad Valenciana	Derbyshire
Cornwall	Detmold
Devon	Dorset
Dolnoslaskie	Drenthe
Dresden	Düsseldorf
Dytiki Ellada	East Anglia
Dytiki Makedonia	East Wales
Dél-Alföld	Yorkshire
Dél-Dunántúl	Eastern Scotland
Eesti	Eastern and Midland
Extremadura	Emilia-Romagna
Franche-Comté	Essex
Galicia	Etelä-Suomi
Illes Baleares	Flevoland
Ionia Nisia	Freiburg
Ipeiros	Friesland
Jihovýchod	Friuli-Venezia Giulia
Jihozápad	Gelderland
Kentriki Makedonia	Gießen
Kriti	Wiltshire
Kujawsko-Pomorskie	Greater Manchester
Közép-Dunántúl	Groningen
La Rioja	Hamburg
Languedoc-Roussillon	Hampshire
Latvija	Hannover
Limousin	Haute-Normandie
Lincolnshire	Helsinki-Uusimaa
Lorraine	Worcestershire
Lubelskie	Highlands
Lubuskie	Inner London East
Lódzkie	Inner London West
Lüneburg	Karlsruhe
Malopolskie	Kassel
Malta	Kent
Mecklenburg-Vorpommern	Koblenz
Molise	Kärnten
Moravskoslezsko	Köln
Nord-Est	Lancashire
Nord-Vest	Lazio
Norte	Rutland
Notio Aigaio	Leipzig
Nyugat-Dunántúl	Liguria
Opolskie	Limburg
Outer London	Lombardia
Peloponnisos	Luxembourg
Pest	Länsi-Suomi
Picardie	Marche
Podkarpackie	Mellersta
Podlaskie	Merseyside
Pomorskie	Midi-Pyrénées
Principado de Asturias	Mittelfranken
Prov. Hainaut	Münster
Prov. Liège	Niederbayern
Prov. Luxembourg	Niederösterreich
Prov. Namur	Noord-Brabant
Puglia	Noord-Holland
Região Autónoma da Madeira (PT)	Nord-Pas-de-Calais
Região Autónoma dos Açores (PT)	Norra
Región de Murcia	North Eastern Scotland
Sachsen-Anhalt	North Yorkshire
Sardegna	Northern Ireland
Severen	Northern and Western
Severoiztochen	Northumberland
Severovýchod	Oberbayern
Severozapaden	Oberfranken
Severozápad	Oberpfalz
Shropshire	Oberösterreich
Sicilia	Outer London South
Slaskie	Outer London West
Sostines regionas	Overijssel
South Yorkshire	Pays-de-la-Loire
Southern Scotland	País Vasco
Sterea Ellada	Piemonte
Stredné Slovensko	Pohjois- ja Itä-Suomi
Strední Čechy	Poitou-Charentes
Strední Morava	Praha
Sud	Prov. Antwerpen
Sud-Est	Prov. Brabant wallon
Sud-Vest	Prov. Limburg (BE)
Swietokrzyskie	Prov. Oost-Vlaanderen
Tees	Prov. Vlaams-Brabant
Thessalia	Prov. West-Vlaanderen
Thüringen	Provence-Alpes-Côte d'Azur
Umbria	Provincia Autonoma di Bolzano/Bozen
Vest	Provincia Autonoma di Trento
Vidurio	Rheinhessen-Pfalz
Voreio Aigaio	Rhône-Alpes
Vzhodna Slovenija	Région de Bruxelles-Capitale
Východné Slovensko	Saarland
Warminsko-Mazurskie	Salzburg
Warszawski stołeczny	Schleswig-Holstein
West Wales and the Valleys	Schwaben
Wielkopolskie	Småland
Yugoiztochen	Steiermark
Yugozapaden	Stockholm
Yuzhen	Stuttgart

(*continued on next page*)

Table A4. continued.

Regions with lower-than-average GDP per capita	Regions with higher-than-average GDP per capita
Zachodniopomorskie	Surrey, East and West Sussex
Zahodna Slovenija	Sydsverige
Západné Slovensko	Tirol
Área Metropolitana de Lisboa	Toscana
Észak-Alföld	Trier
Észak-Magyarország	Tübingen
	Unterfranken
	Utrecht
	Valle d'Aosta/Vallée
	Veneto
	Vorarlberg
	Västsverige
	Weser-Ems
	West Central Scotland
	West Midlands
	West Yorkshire
	Wien
	Zeeland
	Zuid-Holland
	Åland
	Île de France
	Östra Mellansverige
	Övre Norrland

Source: Authors' calculation.

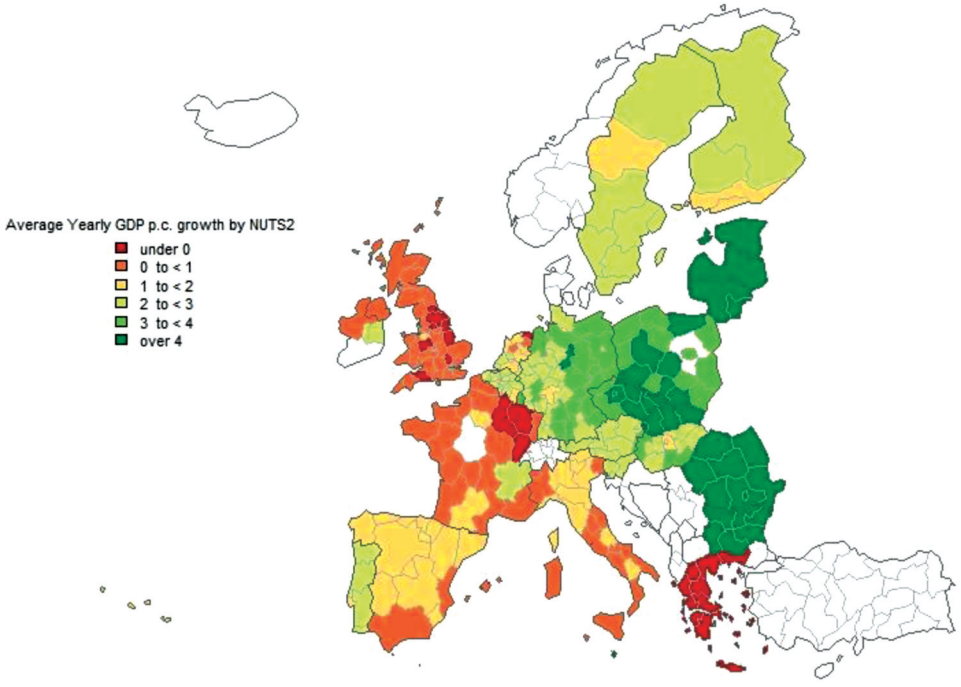

Fig. A1. Map of average GDP per capita yearly growth.